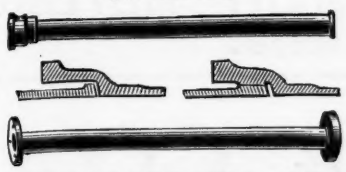
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXX. No. 1792.] LONDON, SEPTEMBER 14, 1897. [49TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



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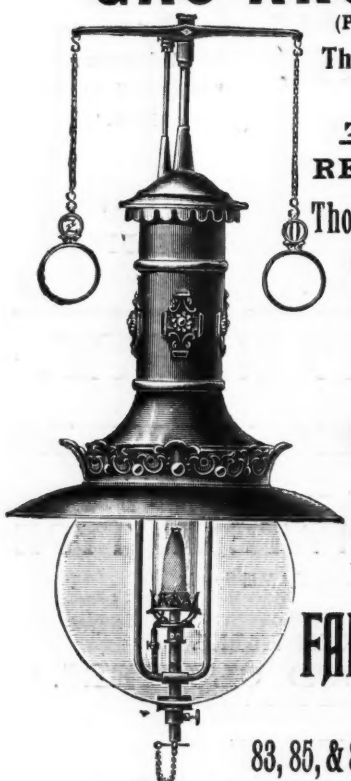

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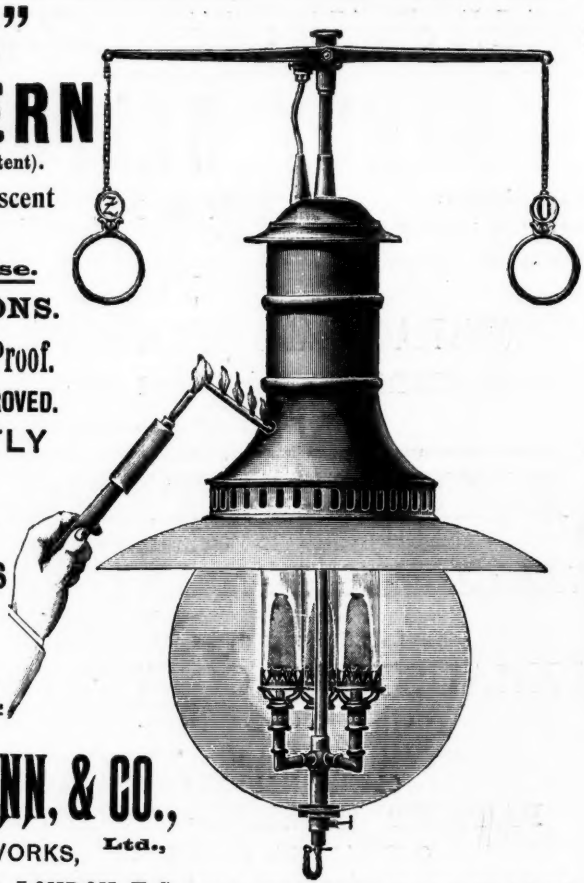

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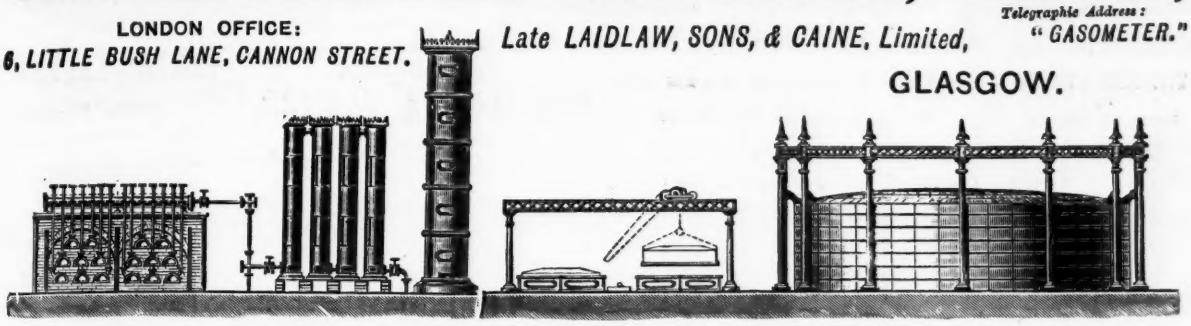

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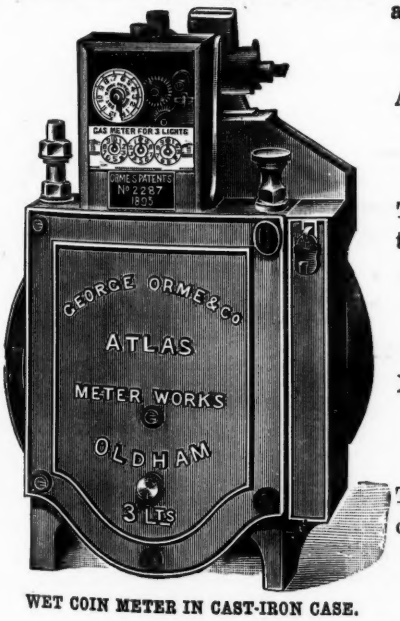

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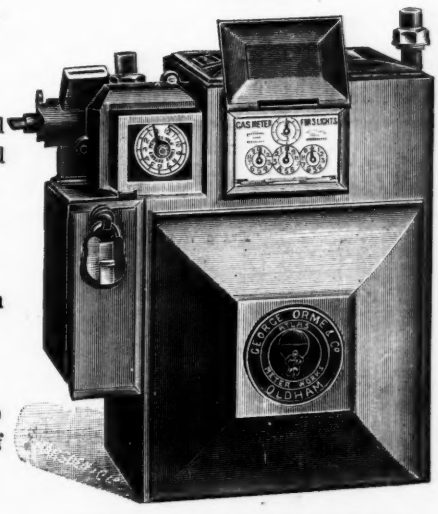

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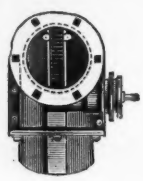

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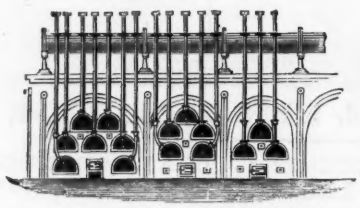

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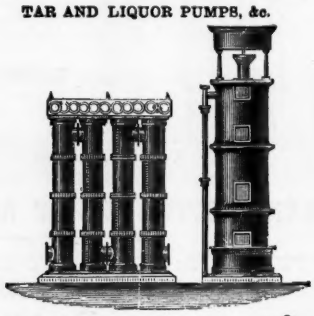

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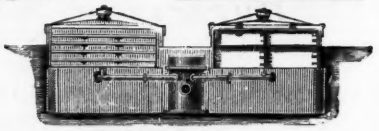

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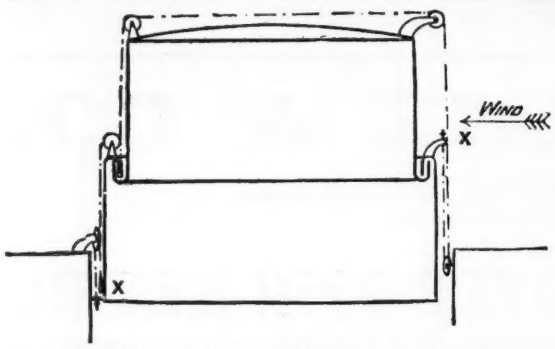

ONE $\frac{3}{4}$-inch Steel Cable in Double Purchase has a controlling power of **60 TONS**

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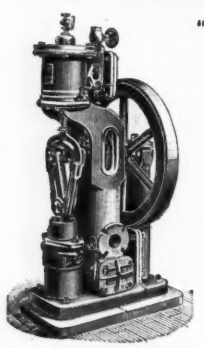

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 898. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

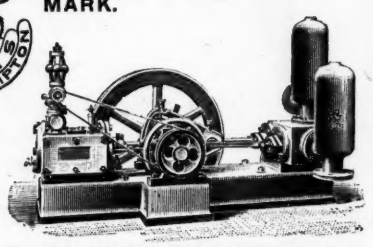

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

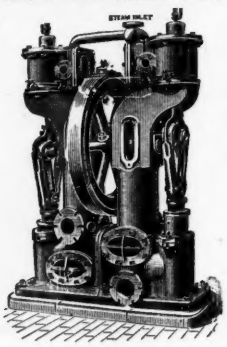

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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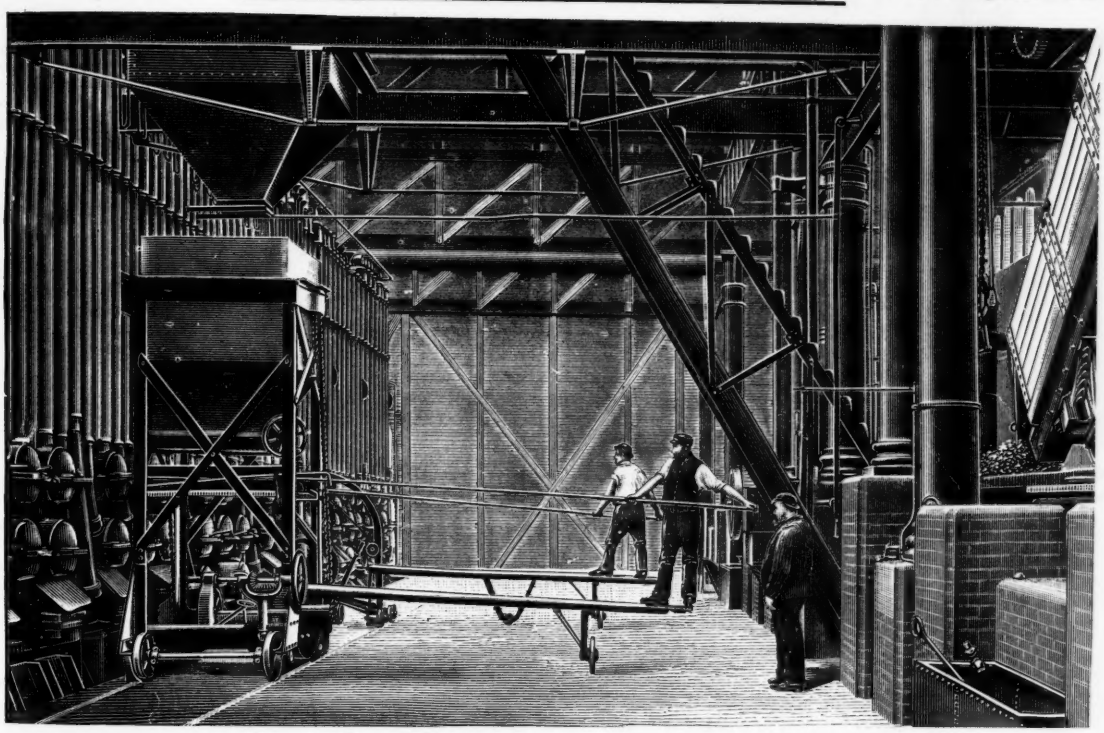

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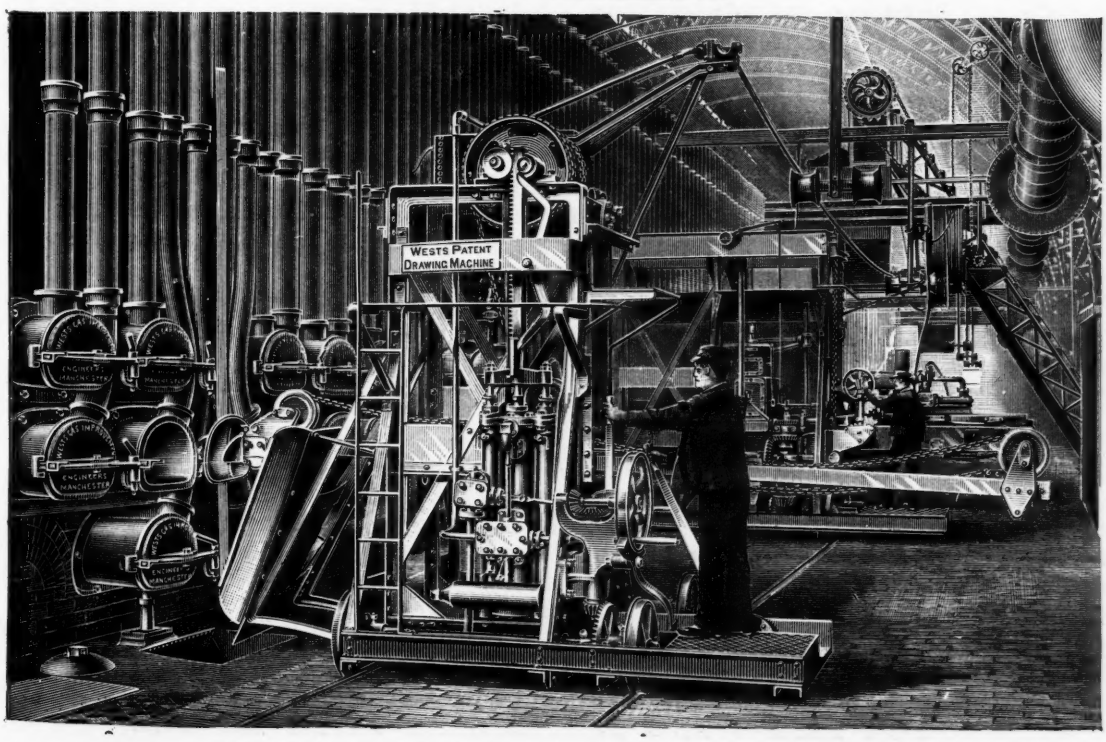

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IMPROVEMENTS IN STREET LIGHTING.

Highest Efficiency with Greatest Economy.

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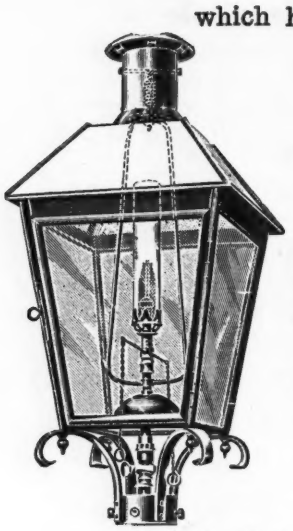
INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of



STREET LIGHTING,

the difficulties caused by VIBRATION having been OVERCOME by the use of the

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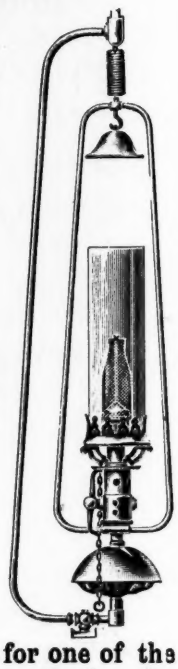
This System of Lighting meets the requirements of all Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting WITHOUT INCREASE OF EXPENDITURE.



The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

"In the matter of maintenance of the street lights, the record is favourable—in fact, more so than the estimate provided. By the test-meter, the average daily consumption works out to 38 cubic feet per light, including bye-pass. The bye-pass consumes with a flame half an inch long, $\frac{1}{5}$ foot per hour. This represents 1000 cubic feet per lamp per annum. The average consumption per light, when in use, works out to 12,900 feet per annum, or about $3\frac{3}{5}$ feet per light per hour. The lighting is continued all the year round, from the average times of one hour after sunset to one hour before sunrise."

"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

"In the matter of cleaning, it may be said that the lanterns require less attention than with the ordinary flat-flame burner."

"The number of lights attended to per man averages 85."

"The 'Welsbach' Light is undoubtedly one of the greatest aids to successful competition that the Gas Industry has ever experienced. Its influence, while reducing the relative cost of light, has advanced the consumption of gas all over the country by the increased satisfaction of the existing consumers, and the attraction of others. The writer feels that its influence should not be confined to the house. It is capable of meeting every competitor in the street, from cheap oils to arc lights, in cost and in effect; and it is hoped that the foregoing experience may lead many others to seek its aid and to realize its efficiency."

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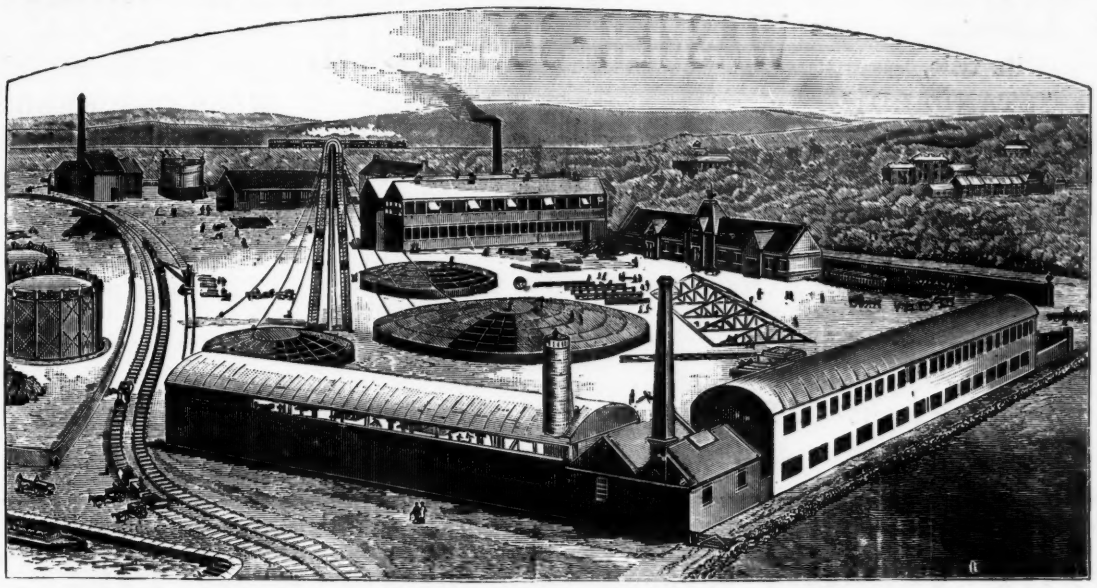

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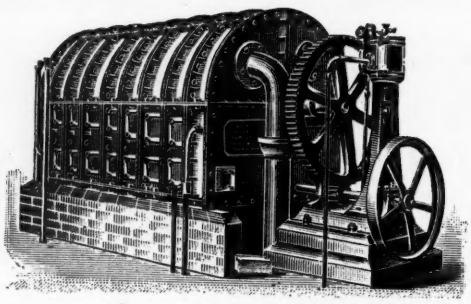
This Apparatus upholds its title, the "STANDARD;" being recognized by leading Engineers as the most efficient Apparatus for the Extraction of Ammonia from Coal or other Gases.



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Number of Patent "STANDARD" Washer-Scrubbers in use at this date

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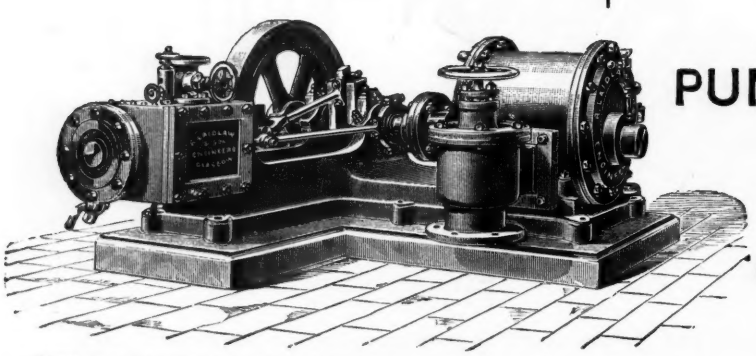

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Belfast	1,700,000	Winchester	200,000
Belfast (Second Contract)	4,500,000	Holyoke, Mass.	600,000
Glasgow	300,000	Hoylake	125,000
Brussels	700,000	Shanghai	225,000
Brussels (Second Contract)	700,000	Stockport	500,000
Liverpool	3,500,000	St. Joseph, Mo.	750,000
Tottenham	750,000	Lea Bridge	350,000
Tottenham (Second Contract)	750,000	Lea Bridge (Second Contract)	350,000
Santiago	400,000	Guildford	350,000
Swansea	750,000	Stockton-on-Tees	500,000
Manchester	3,000,000	Syracuse, N.Y.	850,000
Brighton	1,750,000	Brentford	1,200,000
Preston	1,500,000	Commercial Gas Co.	850,000
New York	1,200,000	Commercial Gas Co. (Second Contract)	850,000
Southport	750,000	Bridlington	125,000
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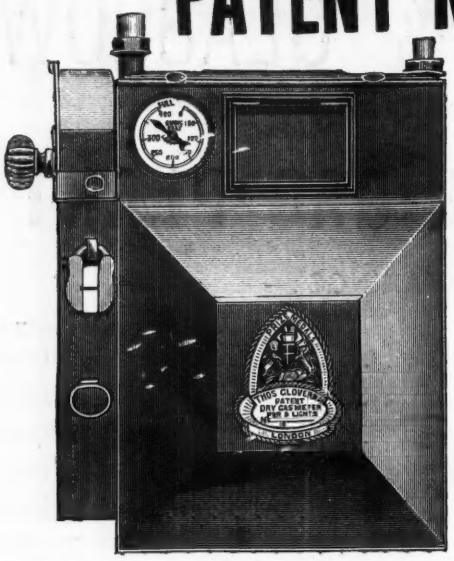

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CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The Trade Union Congress . . . 571
Mr. Chambers on the Coal Trade . . . 572
The Trouble in the Engineering Trade . . . 572
The Eastern Counties Association at Ipswich . . . 572
The Law in Allen *v.* Flood . . . 573

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 573
Electric Lighting Memoranda . . . 573
The Congress on Technical Education . . . 574

NOTES:—

A Table of Gas Engine Patents . . . 576
Architecture and Engineering . . . 576
Dr. Borchers' Carbon Battery . . . 576
Monazite . . . 576

TECHNICAL RECORD:—

Eastern Counties Gas Managers' Association—Half-Yearly Meeting at Ipswich—
General Business . . . 577
Mr. W. J. Carpenter on "Electricity and Gas at Great Yarmouth" 577
Mr. Frank Prentice on "Experiences with Regenerative Firing" 580
Waverley Association of Gas Managers . . . 582
Pacific Coast Gas Association—Fifth Annual Meeting at San Francisco . . . 583
Notes on the Enrichment of Coal Gas . . . 584
The Agricultural Value of Sulphate of Ammonia . . . 586

REGISTER OF PATENTS:—

Manufacture of Illuminating Gas—Young, W., and Glover, S. & T. 588
Acetylene Generators and Holders—Maddock, E. H., and Jones, W. 589
Production of Acetylene Gas—FitzGibbon, L. T. . . . 589
Gas or Oil Engine—Tangye, J. H., and Johnson, W. . . . 589
Manufacture of Acetylene—Bécherel, C. F. J. B. . . . 589
Manufacture of Acetylene—Bécherel, C. F. J. B. . . . 590
Acetylene Generator—Campbell, C. H. . . . 590
Patent Notices . . . 590

MISCELLANEOUS:—

The Ipswich Gas Company's Works—A Large Scheme of Extension Commenced . . . 591
Willson's Patent for the Production of Carbide of Calcium—An Alleged Infringement . . . 591
Provincial Gas Companies . . . 592
Meeting of the Harrow and Stanmore Gas Company . . . 593
Colonial Gas Undertakings . . . 593
An American "Gas Fight"—Warring Combinations of Capital; Story of the Financiering of the Properties . . . 594
Burton-on-Trent Corporation Gas Supply—A Further Reduction in Price . . . 595
Bolton Corporation Gas-Works Finances . . . 596
Metropolis Water Supply—Extension of the Constant Service . 596
Electric Lighting Notes . . . 596
Notes from Scotland . . . 598
Gas and Water Companies' Stock and Share List . . . 598
Current Sales of Gas Products . . . 599
Coal Trade Reports . . . 600

PARAGRAPHS:—

PERSONAL: Mr. A. C. Young; Mr. Thomas Berridge; Mr. George Wood; Mr. Charles Frederic Botley . . . 576
Moissan's Work with the Electric Furnace . . . 575
Professor Dixon on Explosions of Gases . . . 587
Gas-Stoves on the Hire-Purchase System—The National Union of Gas Workers and General Labourers—Proposed Acquisition of the Filey Water and Gas Company's Works by the District Council—Proposals for Improving the Water Supply of Warrington—The Price of Gas in the Out-Districts of Manchester—A Water Diviner's Fees—The Water Supply of Bollington . . . 594
East Looe Water Supply . . . 596
East London Water Company—Ottoman Gas Company, Limited—The Keswick District Council and the Gas-Works—The Eccup Reservoir of the Leeds Corporation—The Ambleside Arbitration Award—Nottingham Corporation Gas Supply . . . 600
Additional Gas Capital Powers Wanted for Halifax—The Farnworth Gas Company and the Local Authorities—Carlisle Corporation Gas-Works—The Northampton Gas Company and the Laying of Electric Light Culverts . . . 601

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EDITORIAL NOTES.

The Trade Union Congress.

THE Trade Union Congress met in Birmingham last week, and consequently the newspapers have been full of reports and comments upon the proceedings of this somewhat egregious assembly of Trade Unionists. Birmingham had officially laid itself out to make much of the Congress; the Lord Mayor (Sir J. Smith) attending on the opening day to welcome the delegates to what is, in an exceptional degree, an artizans' city. In his speech, the Lord Mayor adroitly reminded the delegates that even in his own lifetime the conditions of labour have been vastly improved. No fault can be found with his declaration that "no permanent "social improvement in the condition of the workers would "be effected until every workman was earning a sufficient "wage to keep both himself and his family in comfort. "Good workmen were entitled to a good wage, to a com- "fortable home, and to sufficient leisure to enable them to "appreciate their public parks, libraries, and art galleries." Sir J. Smith also laid stress upon the peculiar glory of Birmingham in being the home of small manufacturers. "Nowhere is it so easy for a man to start business for him- "self." Is this an unmixed advantage? Probably, almost certainly, not; but the boast is a good one for all that.

The chair at the commencement of the proceedings of the Congress was taken by Mr. W. Thorne, the "Gas "Worker," by virtue of his office as Chairman of the Parliamentary Committee. We must confess—not for the first time—to entertaining more than a little esteem for Will Thorne, good stoker and honest man as we believe him to be; only considerably spoilt by association with agitators of the Aveling order, whose Socialism, imported from Germany, neither he nor anybody else understands, while they all profess it more or less. Mr. J. V. Stevens, who is a member of the Birmingham City Council, was elected to the presidency of the Congress, by virtue of one of those cut-and-dried arrangements which so curiously prevail in "popular" gatherings of the kind, and make an onlooker think all the business is managed by wire-pulling. The President's address consisted of the usual string of platitudes, in which but one intelligible idea was buried—that if the Trade Unionists of the United Kingdom would only consent to be federated under some central oligarchy, it would be possible to produce £50,000 per week by the order of a shilling levy. Mr. Stevens did not seem to be alive to the fact that the power to order and spend the proceeds of levies is already a sore point with the contributing members of Trade Societies.

The report of the Parliamentary Committee was a mass of verbiage of the customary character. It could not be denied that so far the professional "Labour" members of Parliament owning allegiance to the Congress have not done much to justify the expectations formed of them; and one of the ordinary members dared to accuse these gentlemen of being only common Party hacks after all. This impeachment was strenuously denied; but the general tenour of the resolutions subsequently passed by the Congress seemed to quite support the idea. Mr. Thorne had charge of the regular resolution declaring that the time has arrived when the hours of labour should be limited to eight per day in all trades and occupations, and instructing the Parliamentary Committee "to bring this about." He was frank enough to confess, however, that no progress whatever had been made in this direction during the previous twelve months, and mentioned that when the Miners' Eight Hours Bill was before Parliament, it was defeated by a larger majority than ever. It must strike a practical man like Thorne as the most useless kind of folly to spend time in passing resolutions of this nature at a Trade Union Congress, which does not mean one-half it says, and has not the smallest power to carry out what it does resolve. Surprise has been expressed in some newspapers that the workers who pay for these congresses are content to go on bearing the expense of such futile parades of stock arguments and official figures. But it must be remembered that the private Society member has practically no voice in the matter. Some light is thrown upon the drift of Trade Union opinion in this regard by a passage in the report of the Parliamentary Committee, which admitted that the utility of the regular deputations to Ministers had been questioned. The Committee seem to be somewhat staggered by this incipient revolt against the usual routine, and acknowledged that there was something to be

said for the protest. "After great consideration," however, the Committee felt bound to confess that, up to the present, no better means of publication has been devised. It is evident that, if members push these inquiries into the utility of the Congress performances very far, the existence of the whole system may be imperilled. As it is, the plea of the Committee for their deputations may be allowed to stand for these and other proceedings of the Congress. There is not much good in them. But there they are; and if necessity should arise, they might be made useful. It is a distinctly apologetic plea; but it is the best that can be discovered by dint of "great consideration."

Mr. Chambers on the Coal Trade.

Some interest attaches to a speech recently delivered in Sheffield by Mr. A. M. Chambers, of the Thorncliffe Collieries, to the members of the British Society of Mining Students, on the occasion of their annual meeting. Mr. Chambers reminded his hearers that coal is at the bottom of the prosperity of this country. At one time coal rose to a zenith; and this Mr. Chambers regarded as about the worst thing that ever happened to the trade—bringing in, as it did, such an enormous amount of capital that production was increased far beyond the requirements of the country. The result was a series of hard times, which, with a few slight exceptions, had continued for the last twenty-five years. Turning to the present situation, Mr. Chambers observed that the great Midland coalfield occupies a perfectly novel position. A very high rate of wages exists, concurrently with a very low state of prices. This order of things was ascribed to the struggle of 1893. The question naturally arises here, How do the coalowners manage to live under such unnatural conditions? Is there not that close and inseparable connection between the rate of wages and the price of coal which the coalowners always put forward as governing the industry, but which the men denied? Mr. Chambers has offered a partial explanation of the facts by remarking that the question of what is to be done now must be referred to the mining engineers and others who could produce cheapest to meet the changed order of things. Does this mean that the coalowner has abandoned the old idea that the rate of wages paid for coal getting should be the squeezable element in the cost of production? Apparently so in Mr. Chambers's case; for he acknowledged that, although machinery had not been so freely resorted to as in other industries, it had been adequate to solve the difficulty of the Midland coal trade—the difficulty of producing coal at a moderate profit.

If these observations of Mr. Chambers bear the natural interpretation most readers would put upon them, their importance can hardly be exaggerated. It would not be fair to say that they justify the great strike of the Miners' Federation in 1893; but they go a long way to indicate that the men have definitely succeeded in maintaining the inviolability of their standard rate of wage. They also convey the impression that the great storm and stress of 1893 had no little effect in clearing the coal industry of some of its constitutional weaknesses and shortcomings. Just as the troubles of 1889 served to awaken gas managers to the necessity of co-operating with mechanicians in reducing their dependence upon hand labour, so it would seem that 1893 was instrumental in shaking some of the traditions of coal mining.

It would be interesting and instructive if some competent mining engineer were to take up the parable from Mr. Chambers, and describe more particularly how, and to what extent, the change admitted by this representative coalowner has worked. There is nothing antecedently improbable in Mr. Chambers's admission, which is indeed quite in accordance with the way of the world. Things get into ruts, in every great industry; and so long as they continue to pay as well, nobody wants to change. The laws of political economy are, of course, mighty and will prevail in the long run; but there is much friction to be overcome in many directions before their operation can be made manifest. "Use and wont" are potent factors in regulating the conduct of human affairs; and in some cases nothing short of a moral earthquake will suffice to upset them. Such an earthquake happened in the coal industry in 1893; and when the immediate effects had passed away, things were no longer in the ruts they had previously occupied.

Mr. Chambers regrets that, owing to the lack of mutual confidence among coalowners, the gas companies and railway companies were not made to pay at least 6d. a ton more for their coals this year. He admitted that there has been a slight increase, but considers that it might have been greater, and ought to have been greater; and he affects to believe that "the necessary advance in "values would not have injured a single coal consumer." Circumstances alter opinions as well as cases; and we are sure that Mr. Chambers knows too much about the gas industry of these kingdoms to believe that such a trifle as an additional sixpence a ton on the cost of coal would not be felt. It is certainly a sign of grace in him that he did not cap this observation by stating that the cost of working the new Compensation for Accidents Law will ruin the coal industry.

The Trouble in the Engineering Trade.

The flow of ephemeral literature concerning the trouble in the engineering trade was last week as copious as ever. Whatever else the deplorable business will effect before it is ended, it is serving to throw a good deal of light upon the motives and methods of Trade Unionism in general and the Amalgamated Society of Engineers in particular. Signs are multiplying that the organizers of the strike are chafing in the strong grip of the federated employers, which, so far from relaxing, is tightening upon the situation in all parts of the country. Even the "Daily Chronicle" has been compelled to report "a reverse at Oldham," and has made a half-apology for having characterized the policy of the employers as "brutal." This curious specimen of the daily newspaper applauds the men for combining for purposes of defiance and defence, yet denies to the employers the right to take the same course. When challenged upon this point, the Editor explains that he has never objected to the employers exercising the right of combination, but declares that it is a straining of that right to employ it "in order to shut out from work all over the "country every member of a body of workmen engaged in "a dispute in one corner of the country." This is puerile. Are not these same men contributing largely from all parts of the country to the carrying on of the dispute in the particular quarter referred to? If strikers in London are at liberty to draw subsidies from the whole of the country, why may not the employers take such concerted action as is open to them to cut off these supplies? It does not look well for the men's chance of ultimately triumphing, when their Press supporters thus affect to ignore the bottom facts of the situation.

It is very evident that the apparently impregnable resistance of the employers is something very different from anything that the wire-pullers of the A.S.E. ever expected. It has been reserved for them to become the means of exhibiting to an astonished world the spectacle of rivals in trade, and owners of capital ordinarily employed in competing businesses, uniting in face of a common enemy. This enemy, we must point out, in order to prevent misunderstanding, is not the workman in himself, but the false views of his place and part in the industrial commonwealth put forward in his name by the ignorant and mendacious agitators into whose toils he has fallen. A strong letter—but not one whit too strong—upon this subject from a "Superintendent Engineer" appeared in the "Engineer" for the 27th ult. Among other descriptive passages clearly taken from the life, the writer declares that "the warfare "which the working man wages continuously with all the "rest of mankind is founded on lies. . . . The most "prominent of these is that every capitalist in the kingdom "is the working man's enemy. The second is that every "other working man is the enemy of any particular work-"ing man. These lies are told and put in circulation by "the leaders, as they are called, of the Unions." Then follows a description of the typical Union leader. The worst of it is, there is no short and easy way of disposing of these parasites of labour. They have a hard life of it, and must always be "on deck," or see a louder-mouthed agitator take their place. The only remedy, the writer thinks, is the long one of better education for the masses of the population. Certainly, the elementary schooling they have had up to now has done them little good; but will instruction bring wisdom? One may well doubt it.

The Eastern Counties Association at Ipswich.

The members of the Eastern Counties Gas Managers' Association met at Ipswich on Thursday last, under the presidency of Mr. J. T. Jolliffe, and spent a profitable and pleasant day. The Association received the hospitality of the

Ipswich Gas Company, and were welcomed to the town by Mr. G. A. Biddell, the Chairman of the Company. The President opened the proceedings by giving a succinct account of the actual condition of the gas-works, which are in course of being remodelled. After this, Mr. W. J. Carpenter, of Great Yarmouth, read a paper descriptive of the recent progress of artificial lighting at this favourite sea-side resort by both gas and electricity. The paper showed that the two systems of lighting are progressing, if not hand in hand, at any rate side by side. A lively discussion followed the reading of the paper. A second contribution to the proceedings of the Association was made by Mr. Frank Prentice, of Ipswich, who described how he had wrestled with, and finally triumphed over, the difficulties of regenerative gas-retort furnaces. This paper was also discussed. The afternoon was devoted to an excursion down the River Orwell; and in the evening the members were entertained to dinner by the Chairman and Directors of the Gas Company. The meeting was exceedingly well managed in every respect, and was one of the most successful in the annals of the Association.

The Law in Allen v. Flood.

It will be remembered that when the important appeal case "Allen v. Flood" was reheard before the House of Lords, a number of the Judges of the High Court were called in to advise the House of Lords on a question of law involved. The opinions of the Judges have since been printed, and some are reproduced in "The Times" for the 4th inst. The question put to the learned Judges was as follows: "Assuming the evidence given by the plaintiff's witnesses "to be correct, was there any evidence of a cause of "action fit to be left to the jury?" Mr. Justice Hawkins, Mr. Justice Cave, Mr. Justice North, Mr. Justice Wills, Mr. Justice Grantham, and Mr. Justice Lawrence answered the question in the affirmative; and Mr. Justice Mathew and Mr. Justice Wright, in the negative. It is unnecessary to repeat the cause of action in this case, which has been mentioned several times in these columns. Essentially the question of law was whether there is any legal wrong in procuring an employer to discharge a workman whose engagement is only by the day or the hour. The point is obviously a nice one; for it may be asked what necessity there is to go behind the bare fact of the terms of engagement, and inquire why these were put into operation for the dismissal of the workman? If it is perfectly well understood that a man may always be discharged from his employment at a certain notice, where is the grievance if this understanding is carried out? Mr. Justice Hawkins had no difficulty in distinguishing the principle by which his judgment in this issue should be guided. Although the termination of the employment may be a lawful act, he who wrongfully procures it is liable to make the injured party compensation. Men have a right to pursue their lawful calling without hindrance; and they have a valuable interest in the probable expectation that their employment will, so far as the nature of the work permits, be continued during their own good behaviour. It is a sort of goodwill in business. "Wrongfully to induce an employer to break his contract "and discharge his workman, is wrongfully to injure that "workman by disabling him from earning his wages. "Wrongfully to coerce an employer to terminate an exist-"ing contract before its appointed time, brings upon the "employed precisely the same character of injury." Mr. Justice Grantham, agreeing, remarked that the right of an individual to work as he likes is as much his personal right as is his right not to be molested in his person or in his property. On the other side, Mr. Justice Mathew could not see that workmen have any continuing right in their employment, and was not aware of any authority for the proposition that the law recognizes a man's interest in his trade, profession, or business as analogous to property in land or to a right created by contract. "A man cannot be "said to have a right to that which no man is bound to "provide for him—namely, employment in his trade or "business." The important thing to be considered is that the House of Lords have not passed their final judgment in the case, the inherent difficulty of which is not at all lightened by the Judges' opinions. However it is dealt with by this tribunal, in all probability an attempt will be made to obtain the sense of Parliament about it; and it will be a matter for thankfulness if wrong is not perpetrated in the endeavour to do right.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 598.)

Although business on the Stock Exchange last week was quite as limited in volume as might be expected for the first week in September, yet it was not devoid of interest, nor free from some degree of fluctuation. The tendency was firm at first; but things soon took a flat turn. The disturbed atmosphere of the labour market gave rise to apprehension, the wretched weather depressed trade and traffic expectations, and the hardening of money touched the prices of the gilt-edged class. But when it was seen that the rate for money was not going to rise, and things looked brighter generally, there was a prompt recovery, which lasted through the rest of the week; and the tendency at the close was decidedly firm. The changes in price have not amounted to much; but Rails in the Western hemisphere have had the best of it. In the Money Market, it was thought by many that the Bank of England rate was bound to go up on Thursday. But the Directors knew better; and there is abundance of money in the open market. In the Gas Market, business opened with a very good show of activity; but it only lasted a couple of days, and then things got rather sleepy. Quotations went to sleep too; for hardly the slightest change was made from beginning to end. But the tendency was very firm and steady; and prices were well maintained. In Gaslights, the "A" stock was active at first, and was done every day at about 319—never varying much above or below; and the closing mark was at that figure. The secured issues were fairly brisk, and commanded good prices. South Metropolitan was in good demand, and looked as if it was going to rise; but after touching top price, it cooled down a little. Nothing occurred to distinguish Commercials. The Suburban and Provincial division was an absolute blank—no business and no movement. The Continental group was almost the same, probably they have never had a quieter week; but what little was done showed firmness to be unimpaired. Among the remoter undertakings were the only changes of quotation noted. Oriental was lowered fractionally; but Cape Town debentures rose to a similar extent. Business in the Water Companies was extremely quiet; but some quotations advanced. East London will advance their dividend rate by ½ per cent.

The daily operations were: Business in Gas was moderate on Monday, and was confined to the Metropolitan Companies. Quotations were not changed. In Water, Kent new rose 3. Tuesday's transactions in Gas showed no change; but Oriental fell ¼. In Water, Kent new gained 2 more. Business in Gas fell very quiet on Wednesday; but the prices of everything dealt in remained firm. Cape Town debentures advanced ½. In Water, Lambeth 7½ per cent. rose 2. Thursday was no brisker; and quotations lay still. There was a little more life in the market on Friday; but again quotations were unmoved. The position in Gas remained the same on Saturday. In Water, East London moved up 1½; and Lambeth 7½ per cent., 1.

ELECTRIC LIGHTING MEMORANDA.

The Case of Gloucester—A Report by Mr. Hammond—Profitable (?) Nature of Electric Lighting by Local Authorities—A Prediction.

This column has been devoted on several recent occasions to the defence of ratepayers from the weakness of their representatives in local government and the machinations of touting electricians, which only too often have the combined effect of saddling the rates with unjustifiable expenditure for electric lighting. We have refrained from attaching these exposures to any particular example by name; there being sufficient family likeness among all schemes of the kind to enable the victims to recognize their own case by the general description. Now, however, we have a definite example to deal with; and as it is a very glaring case, and refers to no more obscure locality than the important and historic city of Gloucester, we shall discuss the matter very plainly indeed. There is, on the face of it, no reason in the nature of things why the city of Gloucester should not be supplied with public electric lighting, if the authorities and the people wish for the accommodation, and are willing to pay for the luxury. The Municipality possess a Provisional Order, under which they have until July next to decide what they will do. For guidance in the matter, they might have gone to men like Dr. Kennedy, or Dr. Hopkinson; instead, they have received a report from Mr. Robert Hammond. We have nothing to say to the discredit of this energetic personage, who first became notorious in the eighties as a popular lecturer on electric lighting. His lecturing tours were very well reported in the provincial newspapers at the time; and the specimen drawing-room furniture which he used to take about with him for the purpose of illustrating his remarks was much and deservedly admired.

It is expedient in the public interest to look closely into the report that Mr. Robert Hammond has supplied to the Gloucester Corporation. According to the version that has reached us, through the "Engineer," Mr. Hammond set out to convince his

clients of the advantages of providing electricity supply and dust-destructor works for Gloucester. The combination is "suspect" from the first glance—recalling as it does the happily abortive Swansea scheme, and the monstrous experiment to which the unfortunate ratepayers of Shoreditch are committed. The report begins by stating that "there are now in the United Kingdom 242 Provisional Orders and Licences of the Board of Trade in force. Of these, 171 are held by local authorities, and 71 by companies; showing that 70 per cent. are under local public control. The bulk of the pioneer work was done by private enterprise; while almost all the newer works have been undertaken by local authorities." Let us interrupt the argument at this point, to draw attention to the plausible way in which the figures are put, and the apparently cogent inference drawn from them. What is the relative importance of the two classes of undertakings owned by companies and local authorities respectively; and why has so much of the "newer work" been left to local authorities?

To proceed: "Taking the thirteen undertakings which have been owned by local authorities for three years and upwards, it is found that with three exceptions—which are satisfactorily explained—in every case there has been a sufficient return of revenue to cover the expenses, *plus* the interest and sinking fund charges, and to leave a surplus available for the reduction of the rates. In addition, many of the works set aside large sums to a reserve fund, as a provision for depreciation and renewal of plant. The total net profits earned by the 25 companies that had been in operation three years and upwards, amount to £119,021, after providing for interest on debentures, and for depreciation." Mark the artful mixing up of the returns from these companies—including, of course, all the London and the big provincial concerns—with the alleged experience of the local authorities! But is the evidence referring to these authorities reliable? According to "Lightning's" table of costs, there are in all sixteen local authorities who have had electric lighting undertakings at work for three years and upwards. This table is not complete, as it does not include such mournful examples as that of the Ealing District Council—where, by-the-bye, dust destruction is not exactly a local Klondike. These examples embrace such exceptional cases as Liverpool, Manchester, Glasgow, and Brighton, which affect the average. They also, however, include St. Pancras, where electric lighting and dust destruction landed the ratepayers, for the fifth year of working, in a loss of £1950; Dublin, where the deficit was £1339; Kingston, where it was £1320; and Southampton, where, after six years of trying, the undertaking, which cost £28,424, shows the magnificent profit of £21. We may scan the same table in another light. To pay interest and sinking fund takes 6 per cent. This is therefore the first charge to be put upon the gross yearly profit, before thinking of depreciation. How many local authorities make as much as this? Nineteen out of the forty-five in the table; and six do not earn 7 per cent. If 3 per cent. depreciation merely were charged, only five local authorites could manage it—Bradford, Glasgow, Hull, Manchester, and Tunbridge Wells.

We cannot, however, pretend to follow Mr. Hammond's Gloucester report through all its points. It winds up with the declaration that "if the combined scheme of electric lighting and dust destruction be adopted on the lines recommended, he was certain that the city would possess a property which would prove a most valuable investment, and which would, in the course of a few years, contribute a handsome quota available for the reduction of the rates of the city." We will not call this prediction an unpleasant name, but if it is realized, it will be the first of its kind in the wide world, and will conclusively show that the age of miracles has not ceased. The conclusion of the matter is a remarkable commentary upon our last week's "Memoranda." The Gloucester Corporation swallowed the report, and decided to engage the reporter to prepare a scheme in accordance therewith. They also appointed a Sub-Commitee "to visit several towns that had adopted electric lighting." Could there be a finer example of the "way not to do it?" The Sub-Committee will probably go to Brighton, Tunbridge Wells, and a few other places of pleasant resort. Bristol and Worcester are at their doors. But it matters little whither they go; for they will only bring back the same prejudices they owned at starting, and their electrical adviser will take care they do not see too much.

THE CONGRESS ON TECHNICAL EDUCATION.

Mention has been briefly made in the "Journal" of the International Congress on Technical Education, which was held this year at the Society of Arts. The "Journal" of the Society contains the official reports of the papers and discussions of the Congress; and scattered through these are many statements and suggestions bearing upon questions of technical education and training such as often crop up in the Inaugural Addresses of Presidents of societies connected with the gas industry.

The first paper to attract notice on this account is that of Dr. Otto N. Witt, "On the Relations Existing between the Teaching of Pure Chemistry and Applied Chemistry." This is a thoughtful commentary on a subject of vast practical importance, since it is universally agreed that it is chemistry that must unlock those hidden properties of matter which will form the bases of the industries of the future. It is unnecessary to show how much has already been done in this way. As Dr. Witt said: "New manufactures, based on chemical principles, have been created and developed to colossal importance; branches of chemical science, considered too intricate and special even to be mentioned in the ordinary text-books of chemistry, have become the foundations of new manufactures; substances which in former times have been known as troublesome refuse have proved a more potent source of national welfare than even the richest gold mines." This is only the beginning; for it is more than probable that the industrial chemistry of the future will yield an even more amazing return than it has done in the past. Much that has been effected is merely sowing the seed; and as knowledge of the natural resources of foreign countries is extended, the scope of industrial chemistry spreads in proportion. "The liquid and gaseous fuels of the United States and Russia" show that the conditions of industrial chemical work are by no means everywhere the same as in the civilized countries of Europe, and that in some cases they are more favourable. "Great continents overflowing with wealth are yet awaiting their development. All that we know of them is that they harbour treasures of enormous magnitude, and that these treasures can only be raised by methods different from those which we have adopted for developing the resources of Europe. Yet the technical chemistry of Europe will for ever be the starting-point for the development of the technical chemistry of the world." Some who read these lines will hope to have a hand in the realization of this fair prospect; and the first question is: How shall they prepare themselves for the endeavour?

As to the precise form to be taken by the chemical industry of the future, Dr. Witt declined to prophesy. "The chemical industry of to-day is totally different from what it might have been expected to become by the most experienced technologist fifteen or twenty years ago. The great secret of the success of applied chemistry lies in its versatility, which enables it to adopt ever new and varying means for a useful purpose." The first point made by Dr. Witt, upon these considerations, is that young industrial chemists should be trained to be men of many resources. Too early specialism in chemistry is disastrous. Engineering training, Dr. Witt thinks, may be as highly specialized as one likes; because in all engineering work the elements are the same. The principles of engineering are fixed, and it is only the applications that are modified. It is not so in chemistry, where theories and principles are constantly changing. "The mechanical arts, dealing with the physical properties of matter, are comparatively simple in their theoretical foundations, but of almost unlimited variety in their practical resources. Applied chemistry, on the contrary, is comparatively simple in its practical aspect, but extremely varied and complicated from a theoretical point of view. From this it results that the only possible way to success in applied chemistry is the acquisition of sound theoretical knowledge. It is a complete scientific education which we must give to our young chemists in order to enable them to be successful in their industrial career."

This seems a large order; but Dr. Witt strongly urges that it is a great mistake to think that the theoretical education of a young chemist may be limited to that part of chemistry which forms the basis of some given industry. He has a horror of smatterers and their so-called elementary equipment. No matter what the ultimate destination of a chemist may be, his education should be strictly scientific and theoretical; and it should embrace general, inorganic, and organic chemistry, without preference for any or either of these separate subjects, but with constant reference to their various applications.

Dr. Witt does not advise that chemical instruction should be largely hypothetical or concerned with text-book speculations. It is impossible to do without hypotheses; but these assume the character of mere philosophical tricks if considered apart from chemical facts. "Almost all our chemical text-books begin with the explanation of this hypothetical part of our science"—the atomic theory, valency, and so forth—"whereas the proper way would be to make the beginner acquainted with facts and to derive from them the laws which govern them. The consequences of such a mistake are almost ineradicable. The young chemist, once accustomed to consider theory as independent of its experimental origin, does not see the necessity of connecting it with his experimental work in the laboratory. The consequence is that the majority of the young chemists of the day, instead of being imbued with one living science, are possessed of two things, both of doubtful value—theoretical knowledge, acquired by memory and soon forgotten in practical life; and practical rule-of-thumb, incapable of helping them in serious research." The so-styled chemist is, in effect, a mere tester, incapable of probing Nature with a pertinent question in the form of an experiment, or of rightly interpreting the result.

Speaking as a German teacher of chemistry, Dr. Witt complains that the majority of young German chemists have an insufficient capacity for research, which is due to their taking it up at too early a period of their studies. They make a rush for the unknown before they are properly equipped by experience of the known. The preparation of compounds and their transformations, with the incessant use of quantitative determinations, should precede exercises in analysis. "Another important point in chemical instruction is the constant reference to the practical applications of facts and theories. If the

teacher would take constant care to explain what alterations of the plant and the conditions of an experiment are necessary for its execution on a manufacturing scale, why such alterations are necessary, then he would contribute more towards the formation and growth of industrial comprehension in his pupils than can be done by any special technical instruction."

Dr. Witt wisely concluded his paper by declaring that we want no schools for producing specialists. Specialism comes as a matter of course in later life. But it is immaterial how deeply a chemist may involve himself in the intricacies of a speciality, he can still obtain help from the contemplation of work accomplished in other branches of his science. This is a view that has often been advocated in these columns. Dr. Witt's last words were: "If we want our schools to produce men fit to reap the great harvest before us, then let them produce chemists who enthusiastically embrace their science as a whole, and who are incapable both of separating practice from theory, and theory from practice." Weighty words, which Major-General Sir John Donelly claimed as a thorough endorsement of the views accepted and inculcated by the Science and Art Department.

Dr. Witt's paper was appropriately followed by one on a very similar subject, contributed by Professor H. E. Armstrong, of the Central Technical College of the City and Guilds of London Institute. Professor Armstrong entitled his paper "Heuristic Instruction in Physical Science;" and the strange word turned out to mean only that the learner should be put to find out his knowledge for himself, rather than have it taught him. "It is the absolute antithesis of the didactic method." Strange to say, just as M. Jourdain talked prose all his life and never knew it, so this oddly-sounding term of Professor Armstrong's signifies the method by which every self-taught man who has "improved himself" since civilization began has perforce proceeded.

Professor Armstrong's new movement, as he terms it, makes quite an interesting little history. The grand idea is "that elementary physical science should be taught from the first as a branch of mental education, and not mainly as useful knowledge. It is a subject which, when taught with this object in view, is capable of developing mental qualities that are not aroused, and indeed are frequently deadened, by the exclusive study of languages, history, and mathematics. . . . The learners should be put in the attitude of discoverers." The quotation is from the report of the Committee of the British Association, presented in 1889. The words must stir the thoughts of all those who, having themselves or their children to educate, are perplexed to know how the mind can best be developed in the direction of accurately observing facts and drawing correct inferences from them. It would be amazing, if it were not so familiar a common-place, that down to the present time our schooling has been utterly deficient of provision of this kind of mental training. Translating into English from classical authors who never wrote anything worth a second thought, the conversion of English poetry into Latin verse, drilling in the irrationalities of the Greek tongue—this is the sort of instruction that to this day is supposed to be the best way to turn out legislators, judges, divines, philosophers, all those who are in due course to be charged with the conduct of the highest affairs of civilized life. The consequence of this superstition, as has often been pointed out, is that while the parents and guardians of the boys submitted to its operation pay the masters, whatever real good the scholars get out of it is due to their own independent efforts. Those who turn out well, in short, are self-taught. Thus while the fact of "heuristic" methods of learning what is useful has all along been the salvation of the existing school system, the credit of putting it forward into its proper place is claimed by Professor Armstrong and his fellow-workers in the cause.

The practical form which the new system takes is that of instruction in chemistry—not because chemical knowledge is preferable to any other kind of knowledge, but because chemistry is a convenient science for the purpose. "The chemistry we desire to have taught is neither the chemistry of the text-books nor that of the technical chemist; and it does not merely involve making a few gases, &c., and indulgence in a certain amount of elementary test-tubing. What we aim at is the reintroduction of the style of work practised by men such as Black, Scheele, and Lavoisier." When thus carried out, chemical education cannot be otherwise than a most efficient preparation, especially for those who desire to follow an industrial career. The introduction of the system into schools is hailed as a means of striking a blow at "the execrable system of examinations," under which children's minds are treated like pigeon-holes—to be crammed with any sort of fact, without regard to the possibility of digesting or applying it.

Professor Armstrong's views were warmly supported by Professor G. F. Fitzgerald, of Dublin. Dr. J. H. Gladstone followed with a paper on "The Teaching of Chemistry in Evening Continuation Schools," in which the same views were advocated, in homelier language, but with equal force. All three papers were discussed together by Sir Henry Roscoe; but nothing material was added to the information contained in them.

Dr. George Lunge, of Zürich, next contributed a thoughtful paper entitled "Remarks on the Teaching of Chemistry," which has received the doubtful compliment of more notice by the newspaper press than was bestowed on any other contribution. This was on account of the author's temerity in denying some of the fundamental tenets of the believers in "popular" education. Dr. Lunge laid it down that a training in pure science, and that of the most thorough kind, is a desirable preliminary in the training of those who aspire to filling the higher positions in chemical works. "So long as this is not a recognized principle, it is in vain to hope for retaining a foremost rank in chemical industry." Dr. Lunge went on to say that it is another question whether it is desirable for the foremen, or even the common workmen, to "possess a certain knowledge of chemistry and technology, such as may be imparted at the Board Schools or at night classes for adults. I am afraid that such knowledge is quite useless to ordinary workmen, who have simply to do as they are told. . . . I do not even think that, apart from isolated exceptions, such knowledge is of much good to the foreman, whose duty it is to carry out instructions, and to see that the men do their work as prescribed by the staff." This reactionary reasoning actually led the learned Professor to the conclusion that "it really seems a great waste of time and means to give some superficial chemical teaching to tens of thousands of workmen, on the remote chance that one of them may gain some real benefit from it, while at the same time many hundreds of educated men are receiving a really efficient training in the same direction, many of whom cannot find properly remunerated places owing to the cheap labour of 'bottle-washers.'"

In the course of the discussion which followed, Mr. Alderman Thomas Snape challenged Dr. Witt's statement that in the chemical industry the principles change as much as the methods. Speaking as an old chemical manufacturer, Mr. Snape observed that in many chemical industries the principles are known; the only difficulty being to devise the plant and arrangements required to put them into operation with commercial success. Mr. Snape mentioned several manufacturing processes in which such success had only been attained by the discovery of the precise mechanical and engineering methods required to carry the theoretical principles into effect. Dr. J. T. Dunn thought the same; mentioning the Chance-Claus system of sulphur recovery as an example of the adaptation of plant to the object in view being the whole secret of the commercial success of the process. Mr. Hooper disagreed with Professor Lunge in regard to the technical teaching of workmen; holding that they should rather try by such teaching to remove workmen's prejudices, which are really a considerable impediment to progress.

Moissan's Work with the Electric Furnace.—In connection with a report appearing elsewhere to-day (p. 591), the following extract from "Engineering" will be read with interest: Perhaps hardly sufficient attention has been paid in this country to the admirable researches of M. Henri Moissan, the eminent French physicist, which have extended so largely our knowledge of the various carbides, silicides, and borides which are produced only at the extremely high temperatures attained by the electric furnace. It appears indubitable that M. Moissan was the first to produce calcium carbide by this means. But, as usual, such discoveries only benefit the public when some commercial man has the foresight and enterprise to take the matter up, find new applications for the product, and lay down plant capable of producing it on a business basis. This honour belongs undoubtedly to an American, Mr. T. W. Willson, who produced the carbide quite independently of M. Moissan's work. Curiously enough, another of M. Moissan's discoveries has had a practically identical history. The remarkable carbon-silicon compound first noted by him was re-discovered by Mr. George Acheson and introduced commercially under the name of carborundum, and is now being manufactured on an enormous scale at Niagara Falls, being utilized as an abrasive. From a recent review of M. Moissan's work in "Le Genie Civil," it appears that M. Moissan has investigated the properties of many other carbides produced in the electric furnace. Some few metals will not unite with carbon even at the highest temperatures attained—amongst them being gold, bismuth, and tin. Others, such as copper and silver, dissolve small quantities of the element without forming definite carbides, such as copper and silver. And finally, there remains quite a large class forming carbides of simple and definite composition, and separating out in the crystalline form. Of these, many produce acetylene when they come in contact with water. The lithium compound —being the composition C_2Li_2—gives, when decomposed by cold water, about 9·5 cubic feet of the gas per pound of the carbide employed. The calcium, barium, and strontium carbides act similarly, while, on the other hand, the aluminum carbide (Al_4C_3) when it is decomposed with water yields pure methane, in which property it resembles the similar compound of glucinum. Many other carbides give rise, when in contact with water, to mixtures of hydrocarbons, among which are found acetylene, methane, ethylene, and other liquid or solid hydrocarbons in small quantity. The manganese compound CMn_3 yields a mixture of hydrogen and methane; and the uranium compound, Ur_3C_3, gives with cold water hydrogen, ethylene, traces of acetylene, and a considerable quantity of liquid and solid hydrocarbons. It is probable that should the reaction be made at a higher temperature, the yield from the latter compound would closely resemble crude petroleum.

PERSONAL.

Mr. A. C. YOUNG, of Maybole, has been appointed Manager of the Kelso Gaslight Company, which position was vacant by the transference of Mr. W. B. M'Lusky to Selkirk. There were seventy applications for the post.

At a special meeting of the Directors of the Leamington Gas Company, held last Tuesday, Mr. THOMAS BERRIDGE (chief assistant to Mr. Charles Taylor, Engineer and Manager of the Derby Gas-Works) was appointed to succeed Mr. William Cross, as Secretary, Manager, and Engineer. Mr. Cross, we regret to say, has been compelled to resign the position owing to his continued ill-health.

In consequence of ill-health, Mr. GEORGE WOOD, the Water Superintendent of the Leeds Corporation, has expressed to the Water Committee a desire to resign. For some weeks, Mr. Wood has been unable to attend to his duties; and his medical adviser recommends a thorough rest for six months. At the meeting of the Committee last Friday, the Chairman (Alderman Cooke) and other members spoke very highly of Mr. Wood and his twenty-four years' service; and it was unanimously decided to grant him six months' leave of absence.

Mr. CHARLES FREDERIC BOTLEY—eldest son of Mr. C. E. Botley, the Engineer of the Hastings and St. Leonards Gas Company—was married, last Saturday week, at the Parish Church of St. Peter, Bexhill, to Miss Ellen J. Reeves, youngest daughter of the late Mr. Charles Reeves, of Bexhill-on-Sea. On the previous Thursday evening, Mr. Botley was the recipient of an interesting presentation. An impromptu smoking concert was held in one of the large show-rooms at the gas-works; and, during an interval in the programme, Mr. Botley was asked to accept a very handsome marble clock and ornaments as a token of regard from those employed on the works. Everybody gave something towards the presentation fund, and heartily wished Mr. Botley many years of health and happiness. The clock bore the following inscription: "Presented to Charles Frederic Botley, as a token of esteem, by the officers and men of the Hastings and St. Leonards Gas Company, on the occasion of his marriage."

NOTES.

A Table of Gas-Engine Patents.

Students of the gas-engine will find in the "Engineer" for the 3rd inst. an article by Mr. James D. Roots, with which is printed a table of patented inventions relating to cycles of internal combustion engines dated from 1794 to the end of 1894. Discussing the term "internal combustion engines," Mr. Roots remarks that it contains a fairly approximate descriptive definition of gas and oil engines, and is possibly the best that could be devised for the later makes of these engines. Yet the title is open to the objection that it also embraces gunpowder, gun-cotton, and all similar fulminating engines. Mr. Roots excludes this class of motors from his list, though some of them are on the border line between internal combustion and hot-air motors. He also excludes all engines not possessing a cylinder and piston. With regard to the cycles of gas and air motors, Mr. Roots has found, from his study of the patent specifications, that the inventive faculty of patentees has worked in riotous profusion in this matter. This author criticizes the classifications of internal combustion motors adopted by Mr. Dugald Clerk and M. Witz; and he has made out a category of his own, which is based upon a system of three classes and ten types. So far as the first classification goes, the three main classes are, in effect, similar to those of Mr. Clerk and M. Witz; but there are several important modifications. Under this system, there should not be any difficulty in searching for examples of any particular kind of gas or hot-air engine. The labour of compiling such a list must be enormous; and while the author is quite prepared to be told that he has made some omissions, he believes he has in his table a very large majority of the specifications and inventions referring to cycles of internal combustion engines between the years 1794 and 1894 inclusive.

Architecture and Engineering.

In a thoughtful series of papers published in the "Builder," Professor Banister F. Fletcher has discussed the influence of material on architecture. The author brings out the principle that true architecture is largely the expression of the nature of the building material. Modern building materials include iron, cast and wrought, and steel, which neither the Greeks nor the Gothic masters knew. If they had known them, they would certainly have used them—that is, they would have been as much engineers as architects. For, the author concludes, the true architecture of the nineteenth century is engineering. He cites the Machinery Hall of the Paris Exhibition, with its clear span of 375 feet and height of 141 feet, as a masterpiece of construction worthy to rank with the most daring of Roman and Gothic buildings. Finally, he observes, the architect and the engineer being separated, and the former not possessing the scientific knowledge proper to his calling, inclines towards methods in previous use, and in cases of doubt prefers to err on the side of excess of strength, and hide his inexperience behind what he deems rules of art, but which are often only those of routine. The architect is being reduced to the condition of a mere decorative designer; the true motive power in the design of constructions remaining with the engineer. The divorce of engineering from architecture has resulted in the production of structures whose sole merit is that of economy—from bridges to gasholders. It is admitted that some of these structures, partly by reason of their mere dimensions, are works of some grandeur, perfectly emblematic of the spirit of the age, and expressive of that spirit. Still, Professor Fletcher asks, if their designers had been men trained to refinement of the eyes, and to a sense of both delicacy and strength in contour, as well as to expertness in constructive science, would they not have been more beautiful? It is a question that must be answered in regard to many engineering works in the negative. There are some necessary structures which the word beautiful could not be made to fit by any process of adaptation.

Dr. Borchers' Carbon Battery.

Some little time ago Dr. Borchers published an account of a cell designed to produce electrical energy directly from the oxidation of carbon used in some of its gaseous compound forms, notably carbon monoxide. The original idea was to supply carbon monoxide and air to indifferent electrodes immersed in a solution of cuprous chloride. This substance, having the property of reacting with both oxygen and carbon monoxide, was chosen to bring about the oxidation of the carbon monoxide in such a manner as to produce electrical energy instead of heat. The designer did not succeed in sustaining his claims under criticism; and the so-called carbon cell was withdrawn. At the recent general meeting of the German Electro-Chemical Society, held in Munich, Dr. Borchers read a paper describing various experiments made by himself with the object of determining whether carbon monoxide can be oxidized in an electrolytic cell with the production of current. Our contemporary the "Electrician" has criticized this effort; denying that it rehabilitates Dr. Borchers in the eyes of those who regard him as an unconvincing experimentalist fatally sanguine in his theoretical views, and easily led astray by apparent confirmations of preconceived ideas. "That this dictum is not unduly severe is sufficiently evident from a single paragraph of Dr. Borchers' paper. He says that, in experimenting with an apparatus . . . . in which the compartments containing the electrolytes were separated by a mercury layer, he used an ammoniacal solution of cuprous chloride, and began to pass in coal gas without placing the electrode in the other vessel. In consequence, the whole of the interior of the compartment in a short time became 'covered with metallic copper.'" It is denied that this deposit was metallic copper, because "it is improbable that coal gas will reduce any copper from ammoniacal cuprous chloride. But it is certain that if it contains acetylene, as it commonly does, it will precipitate cuprous acetylide, which is red and sufficiently like metallic copper to deceive the unwary." A slight tap of a hammer on the substance might elucidate its nature. In any case the idea of using coal gas to demonstrate the possibility of obtaining electricity direct by the electrolysis of a carbon compound is quaint.

Monazite.

A short memorandum on monazite, embodying all that is known of the subject, has been published by Mr. H. B. C. Nitze, in the "Journal of the Franklin Institute." The author states that it is only within the past few years that monazite has become one of the important economic mineral products, through its use for the manufacture of the mantles of the Welsbach incandescent gas-light. The demand for this purpose stimulated the search for the mineral, which was soon found to exist in many places where its presence had not been suspected before. Monazite is essentially a phosphate of the rare earths cerium, lanthanum, and didymium. Small variable percentages of thoria and silica are also almost always present—some considering them to be an impurity, while others regard the thoria as a primary constituent. Monazite is an accessory constituent of the granitic rocks, and their derived gneisses, over widely separated regions of the earth's surface; and further search and study may reveal its universal presence in most granites and gneisses. The main constituents of granite (quartz, feldspar, and mica) all contain the monazite as intergrowths, though it appears to be more generally confined to the feldspar. Monazite crystallizes in the form of needles, mostly microscopic, though some rare specimens have been found in Virginia 5 inches long. It is a brittle mineral, with a conchoidal to uneven surface, transparent in the purest specimens, and coloured different shades of yellow. The economically valuable deposits are found in the placer sands of streams and rivers, in the irregular sedimentary sand deposits of old streams and bottoms now covered up, and in the beach sand deposits along certain sea shores. Monazite, being heavy, is washed out of the sand deposits in the same manner as gold, with which it is sometimes associated. The raw material is valued for its content in thoria. The budding monazite mining industry of Carolina was rendered unprofitable by the discoveries in Brazil, where the sand occurs naturally on the beach, and can be loaded into ships as ballast. The supply from this source appears to be unlimited, and the price quite low. This should assure the future of the incandescent gas-light.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Ipswich.

The Eighteenth General Meeting of this Association was held at Ipswich on Thursday last; and it will long be remembered by the members for the heartiness of the reception accorded them by the Chairman and Directors of the Ipswich Gas Company, and their Engineer (Mr. J. T. Jolliffe), the President of the Association. Nothing was wanting to show the high esteem in which Mr. Jolliffe is held by his Board; and, on their part, the members testified to his popularity among his professional brethren by attending in unprecedented numbers. The morning was devoted to business; the meeting being held (by the permission of the Mayor) in the Town Hall. Within a few minutes of the appointed time—the early hour of eleven—the President took the chair; and the proceedings at once commenced. Indeed, it was due to the exemplary courteous firmness with which Mr. Jolliffe insisted on punctuality throughout the day that the programme was carried through without a single hitch.

A Hearty Welcome.

Mr. G. A. Biddell, the Chairman of the Gas Company, asked to be permitted, before he delivered a message of welcome to the Association, to offer his sincere congratulations and those of his fellow Directors to Mr. Jolliffe on his election to the presidential chair. He was sure it could not be more worthily filled. The honour conferred upon Mr. Jolliffe did credit to the Committee for their wise choice of such a man of mark. The Directors also felt that the reflection of his election was a compliment to them. On behalf of the Directors, he had the pleasure of offering the Association a hearty welcome; and he wished them a happy and profitable day.

The President, on behalf of the Association, thanked Mr. Biddell most cordially for his warm words of welcome. Many of the members had a lively recollection of the pleasure they experienced at their last meeting at Ipswich some years since. In regard to Mr. Biddell's kind reference to himself, he thanked him most heartily; and added that he considered himself fortunate in having the good opinion of such a Board of Directors.

Confirmation of Minutes.

The Hon. Secretary (Mr. J. H. Troughton, of Newmarket) read the minutes of the spring meeting at Peterborough; and they were confirmed.

New Member.

Mr. E. W. Smith, of Chelmsford, was elected a member of the Association.

Presidential Remarks.

The President said he could add nothing to the words of welcome that had been so kindly and eloquently addressed to the Association by Mr. Biddell. He could but reiterate them, and add his own sincere hope that the time the members were to spend in Ipswich might prove both profitable and pleasant. Having addressed them so recently as March last on matters generally cognate to their industry, he might be excused from doing so again. He had intended to give a brief history of the Ipswich Gas Company's undertaking; but he had been relieved even of this by the courtesy of the Editor of the "East Anglian Daily Times," who had in that day's issue given a brief history of the concern. They would have gathered from this history that the works were in a transition state. Owing to the continued growth of the Company's business, he had found it necessary—some two or three years ago—to submit, for the approval of his Directors, a scheme for doubling the capacity of the works. This was now being carried out. Many of the old buildings (which had done good work for 70 years and upwards) had been removed, and others substituted for them; and more would have to follow. A new three-lift gasholder of a million cubic feet capacity was in course of erection, and was at present in a very interesting stage for their inspection. Two papers were to be read, both of special interest. That by Mr. Carpenter on "Electricity and Gas Supply in Great Yarmouth" opened up somewhat new ground to them, and should excite their keen interest, and allay the apprehensions if any existed, in the minds of those who were anxious concerning the possible effect of their newest, and by some considered to be their most formidable, competitor. Mr. Prentice's paper treated of his experience with regenerative firing, recording his failures as well as his successes, for which he thought he was to be highly commended. It was common enough to trumpet forth their successes; they rarely recounted their failures, though probably more was to be learned from failure than from success. In conclusion, he thought he might claim that the gas industry was more prosperous now than it had ever been.

Mr. W. J. Carpenter (Great Yarmouth) then read his paper as follows:—

Electricity and Gas at Great Yarmouth.

The Corporation of Great Yarmouth obtained a Provisional Order for electric lighting in 1890, and carried the same into effect, after considerable inquiry, by proceeding to erect buildings and complete an installation of electricity. The buildings, designed by Mr. J. W. Cockrill, Borough Surveyor, are handsome and substantial in appearance, and were commenced in 1894; and the Marine Parade, among other principal thoroughfares in the town, was lighted by electric arc lamps in the autumn of that year. The station buildings, which occupy a site at the extreme south of the town, comprise a boiler-house and chimney, engine-room, stores, and engineer's offices. I purpose giving a short description of the plant employed.

The boiler-house is commodious, and contains two Babcock and Wilcox boilers, each normally evaporating 4500 lbs. of water per hour, with feed water at 60° Fahr.; and two Babcock and Wilcox boilers evaporating 6000 lbs. of water per hour, with water at 60° Fahr. These boilers are fitted with Holden's injectors, for burning oil in conjunction with ordinary firing. The oil obtained from Scotch blast-furnaces is used for this purpose. Water is supplied by Worthington steam-pumps, through a feed-water ring-main, with duplicate service to each boiler. A Green's economizer, with 192 pipes, forms a valuable adjunct, and does very satisfactory work. The main steam-pipe is in the form of an elongated ring, suspended from brackets and free to expand longitudinally. Copper bends are used in connecting to boilers and engines; and Hopkinson valves are employed throughout. There is sufficient coal storage for 300 tons. Some gas coke is used mixed with coal, during the hours when steam consumption is light.

There are six engines. One 300 indicated horse power Peache engine by Davey, Paxman, and Co.; three 150 indicated horse power by Willans and Robinson, Limited; and two 60 indicated horse power by the same firm. The two latter drive the arc lighting dynamos by ropes; while all the other engines are direct coupled to alternators, which furnish the supply to private consumers. The two 60 indicated horse power engines are compound two-crank, running at a speed of 450 revolutions per minute; and the others are compound three-crank engines with a speed of 385 revolutions per minute.

The dynamos are by Messrs. Crompton and Co., of Chelmsford. The alternators have a disc armature rotating between a double ring of pole pieces; the latter being hinged so as to allow easy access to the armature in any instance where it might be found necessary to replace a coil. The bearings of the alternators are all fitted with oil rings or pumps, to ensure continuous and complete lubrication. The arc light machines, two of which are driven by each engine, supply about 30 lamps each; and there are duplicate sets. Adequate surface condensing plant is provided; cooling water being taken from the harbour. The condensed water is discharged into the hot well, and is drawn through a filter to remove oil.

The switchboard is made up of a number of similarly fitted slate panels; one being provided for every alternator, and one for each feeder cable. Each panel contains the necessary switches and instruments which indicate the pressure or voltage and the quantity of current passing at the time. There are also instruments showing the total current and the pressure maintained at various points in the town. A recording instrument measures the total output during the twenty-four hours. There is also a panel for the four arc light machines and two circuits, which are kept distinct from the other switching arrangements.

The arc lamps are arranged in two circuits of about 30 lamps each; one circuit being extinguished at midnight. The lamps are arranged in series; the same current passing them all, one after another, and finally back to the dynamo through a return wire. The lamps and posts were supplied by Messrs. Crompton and Co.

The alternators produce current at a pressure of 2000 volts, which is reduced to 100 volts by means of transformers; the current being proportionately increased. Thus an output of 25 amperes × 2000 volts at the works becomes 500 amperes × 100 volts when transformed near the consumer's premises. The object of this transformation is to save money in cables; the size of a conductor depending on the quantity of current (amperes) which has to pass through it. Therefore, the high-pressure cables from the works to the transformer chambers are small, while the local distributing-mains, which are in short lengths, are comparatively large.

The private-lighting plant was completed and started early in 1895; and the following statement will suffice to illustrate the growth of the concern from that time:—

Date.	Number of 8-Candle Power Lamps.	Number of Public Lamps.
Feb. 1, 1895	960	64
Dec. 31, 1895	5,470	66
„ 1896	8,350	68
„ 1897 (estimated)	10,500	72

It will therefore be seen that electricity has been liberally patronized in Great Yarmouth during the comparatively short career of the department; and it will doubtless interest you to know to what extent electrical competition has affected the Gas Company's business. With a view of giving you the exact position of affairs, I prefer to bring forward the totals of the net gas-rental during the period of competition. You will then see how we have fared in pounds, shillings, and pence, which, to my mind, is the soundest way of looking at the subject:—

Date.	Net Gas-Rental.
Dec. 31, 1894	£18,062
„ 1895	18,110
„ 1896	18,115
„ 1897 (estimated)	18,750

The current year, up to date, has shown a considerable increase; and the estimation is based on figures already to hand. The price of gas has not been altered during the period as given. The figures are suggestive; and it would appear that electricity has steadied the consumption somewhat—at any rate the probable increase in consumption. But it had not been usual with us to experience great increases in consumption during the few years previous to the introduction of electric lighting. Therefore, seeing our business of to-day, we have concluded that we have to thank our electrical friends for their competition, which has produced such a stimulating effect upon the gas interest in our town.

The number of consumers upon the books of the Company is continually increasing, as will be seen from the following figures:—

Date.	No. of Consumers.
Dec. 31, 1894	2441
„ 1895	2536
„ 1896	2692
„ 1897 (estimated)	3000

The new consumers include users for gas-engines, consumers by ordinary meters, consumers by coin meters, and supplies to gas-cookers and other gas appliances. It is our experience that the public, in many instances at all events, do not rely entirely upon one means of lighting, but prefer a dual system of gas and electricity, or electricity and gas, as the case may be.

From the date when electrical competition commenced, we have been very careful to analyze our total consumption per day, in order to detect at once any inroad in our business; and it is pleasant to record the fact that, if at any time we had a slight decrease in our hourly consumption at night, we have now not only recovered our position, but have to place upon record a very substantial increase, both on account of the night consumption and of the daylight hours.

This very satisfactory state of things, so far as we are concerned, has been brought about, in my opinion, by various causes, some of which I enumerate: (1) The public have been gradually educated to the use of a greater amount of artificial light, by the introduction of electric arc lamps. (2) A more general demand for gas has been evinced during the past few years, probably owing to the better condition of trade. (3) Cooking by gas has been identified as quite the correct form of cooking arrangement to adopt. (4) The continued improvements in gas appliances have rendered them much more acceptable to the consumers. (5) Our good old town is improving in so many ways that there are practically no empty houses. (6) We have endeavoured to meet the growing demands of our consumers in a liberal spirit.

Probably the most trying experience in electrical competition is during the period of launching the scheme, and the preparation of the station in readiness for the complete annihilation of the gas interest. Locally the air is then filled with wonderful anticipations, of a kind which are not authoritative, as to the future of both the electrical and gas concerns. The former is then, of course, popularly expected to succeed at the expense of the latter; and a large amount of banter is indulged in by electrical partizans when in the presence of shareholders of gas concerns. It is at this particular time that gas shareholders should not allow themselves to be persuaded to part with their stock. In our case we had, I believe, a few shareholders who did so; but it must be a much regretted incident, seeing that to-day our £30 shares are realizing £7 to £8 more than at any period in the history of the Company. Well, we have passed through this experience, and have always endeavoured to look with equanimity upon the whole matter; and to-day we have in Great Yarmouth both electric and gas concerns running along smoothly side by side—the electricity works still rapidly increasing, and the Gas Company able to show a substantial profit balance.

As to the future, I think that we may claim to be in a very fortunate position. There are large numbers of houses still without gas in Yarmouth, and gas-cookers are going particularly strong, added to which the coin meter is serving us in good stead, and is likely to do so for some time to come. We consider the point of saturation a long way off.

I am not, of course, qualified to forecast the future of the electrical undertaking. Free wiring, with coin meters, is now occupying the attention of local authorities throughout the country; and it may assist in building up a larger business in current. From my point of view, however, free wiring would appear to offer many difficulties to a corporation undertaking. Perhaps the greatest of these difficulties, when the wiring is done by an outside company, would be the question of "shorts" and "overs;" and, again, mechanical imperfection of the meters during the experimental period cannot be lightly overlooked. Some of these difficulties could be, perhaps, overcome by the department doing its own wiring and supplying meters, as in the case of gas concerns. But it is questionable whether a free system would pay with lighting alone. Taking our own case, I am convinced it would not. It is the stove work, in conjunction with the free system, which warrants a continuance of the expenditure necessary to provide for the free-fittings scheme.

In conclusion, I trust that if any of you meet with electrical competition, your experience will be similar to ours, which, after all, is only similar to that of gas concerns in many other towns where electric lighting is already in vogue—viz., that gas consumption, in the concrete, is not adversely affected, but receives assistance by the fillip given to lighting and other matters by the introduction of a competitor.

Discussion.

The PRESIDENT said the members were indebted to Mr. Carpenter for having prepared his paper. It was somewhat new to them as gas engineers to have to deal with the subject of electricity. It was satisfactory to know that the Great Yarmouth Gas Company had not suffered through the newer form of competition; but that, of course, was generally borne out now, and generally recognized. Some twenty or more years ago, when electricity was fresh to them, many shareholders parted with their holdings in gas companies, much to their own regret, as subsequent events proved. He hoped gas shareholders had learnt more wisdom now, and would not be scared by any imaginary conflict that was likely to take place between the two forms of lighting. They had no general electric lighting installation in Ipswich—at all events, it had not been taken up by the Corporation yet; and he hoped it never would be. Corporations seemed to have a kind of craze for entering into trade; but he thought they should keep to the work for which they were brought into existence. He knew he was in a hopeless minority in this case, and would have to bow to the force of circumstances; but he could not help expressing his opinion that no real and valid reason had been advanced why corporate bodies should go in for electric lighting. It was within the reach of almost the smallest trader to put in an installation, with which to generate electricity for his own needs, very much cheaper than an electric lighting company could supply him. A gentleman who had a shop in the town had an electric lighting plant, which cost him £150; and with it he was able to generate electricity at 3d. per unit. The installation was driven by a gas-engine, as was also another of a larger character, which was used for lighting a public institution. This installation, he was told, cost under £400; and taking out the total expenditure year by year, the cost of the electricity did not amount to 2½d. per unit. Thus it was within the scope of every trader to have his own installation of electricity. It could not therefore be said that there was any need for the Corporation to supply it for other than street lighting purposes; and he could not believe it was required for that purpose even. He had seen the electric lighting in Yarmouth, as well as in several other towns; but in no case had he seen an installation that came near the lighting by gas with Denayrouze burners. Some little time back he was asked by a firm in the town, who were having an electric-lighting installation of their own, if he could do anything by the aid of gas to compete with electricity. He said he could, and as cheap, if not cheaper. He obtained a Denayrouze burner; and he thought the Corporation Gas Inspector (Mr. E. C. Sayer) would bear him out that gas lighting by this burner was infinitely superior for lighting purposes, and that the diffusive power was much greater. They could have furnished the firm in question with this form of lighting at a cheaper rate than they were able to supply themselves with light from their electric installation.

Mr. A. W. RANKEN (the Electrical Engineer to the Great Yarmouth Corporation) asked the President whether, by means of the private installations he had mentioned, the consumers were able to get light at any time of the day.

The PRESIDENT: Certainly, by starting their gas-engine.

Mr. RANKEN said it seemed to him that, if they had to run their gas-engine and plant all day in order to supply one or two lights, the expense would come out rather more than if they took their supply from the electric lighting company or corporation as the case might be.

Mr. W. R. CHESTER (Nottingham) remarked that timid shareholders were so apt to rush into all kinds of fears when electrical competition was mentioned, that putting before the gas world the facts given in the paper as to the competition at Great Yarmouth (which had been fairly severe, judging from the rapidity with which the electrical lamps had accumulated) would have the effect of steadying the price of gas property, and of preventing shareholders from rushing on to the market with it. Mr. Carpenter's experience was one which, he thought, had been repeated in many other towns throughout the country where electricity had been introduced. Probably the members would remember that he (Mr. Chester) dealt somewhat elaborately with this subject in his Presidential Address to The Gas Institute last year. The result of the investigations he then made had been more fully confirmed since. One of the facts he brought out was that the annual growth of increase in the consumption of gas was equal at that time to about two electric lighting installations such as that they then had in operation at Nottingham. They had since had a further year's experience; and the growth of increase in the consumption of gas was now more than four times that of the total output of the electric-lighting installation. Mr. Carpenter did not seem to have had quite such an experience as that, because his consumption of gas had not increased in like ratio. But still there was a very interesting increase; and probably Mr. Carpenter would be able to tell them what proportion the total increase in the rental represented as compared with an equal amount of electric lighting. There was no doubt the Yarmouth Gas Company had been very fortunate in having an enterprising Engineer who was able to deal with competition of this class, and not only

hold his own ground, but advance in face of competition which had been very severe.

Mr. W. D. CHILD (Romford) shared the feeling that had been expressed by the author, that electric lighting was more calculated to do gas companies good, and assist in the growth of the business, than injure them. Owing mainly to the electric light, the public had become accustomed to more intense lighting, and so had called upon the suppliers of gas to furnish them with better and more numerous burners for illuminating their premises. One point Mr. Jolliffe had made was as to the establishment of private electric lighting installations, which had been carried out on very reasonable terms. From the little experience he (Mr. Child) had had of them, he should heartily welcome the adoption of private plants at Romford. They had one in the town; and a gas-engine furnished the motive power. The gas account for this establishment had been just about three times what it was when it was lighted by gas in the plain and straightforward way. He was, of course, glad to see it; and he hoped the example of this particular customer would be followed by many others in the place.

Mr. J. CARTER said they had had no experience at Lincoln with electric lighting, except in connection with one or two private installations. Mr. Child's remarks as to his experience with the one at Romford just about represented the case with those at work in Lincoln. The gas accounts had been much higher than they were before there was any electricity on the premises. It seemed to him that gas managers were in danger of not sufficiently appreciating the importance of the competition between electricity and gas. If they were alive to their responsibility, if they opened their eyes sufficiently to the fact that they had a formidable competitor in the market, and if they put forward all possible methods to popularize and extend the use of gas for the many purposes to which it was now applied, they need have no fear as to the effect of the competition upon the gas industry. If, however, they regarded electricity as an unimportant competitor, and simply ignored the claims made upon them as men in charge of gas undertakings, their rival might, while they were asleep, make inroads upon their business. They must put all the energy, intelligence, and skill which they possessed into the gas business in order to maintain their position.

Mr. D. FORD GODDARD, M.P. (Ipswich), thought the time had come when no one would be so scared by electric lighting as to hastily part with his investment in gas shares. Still it was not an ill-timed thing to bring forward papers on the subject, in order to keep those who were interested in gas undertakings up to the mark as to what was going on in the matter. He had followed with great interest the growth of electric lighting in this country; but he had never feared it. At the time when electric lighting was little known, he read a paper on it before a small scientific society in the town; and people were rather surprised that he who was so intimately connected with gas manufacture should have ventured to enlighten anybody on the subject. What he felt then had since been proved to be true—that electricity as a lighting power would not injure the gas industry. Its proper place, and its useful place, was as a "gentle stimulant" to the gas industry. (Laughter.) The growth of electricity, its facility, and its many advantages had awakened a keen interest in developing all kinds of gas appliances. They looked at this matter almost entirely from the side of the gas manufacturer; but he wished that someone who really had the interests of gas consumers at heart would take up this question from their standpoint. In years past, it had been the tendency for consumers to be constantly asking for something better; and there was nothing that had served the interests of gas undertakings more than electric lighting from that point of view. The consequence was that, instead of economizing their gas accounts, the consumers were always increasing them, because of the natural growth of the demand for greater light. Mr. Jolliffe had referred to a private installation being able to provide electric lighting at 3d. and under per unit; and he (Mr. Goddard) would like to know how that compared, light for light, with the price of gas in a town like Ipswich. He also asked Mr. Carpenter what was meant by the terms "shorts" and "overs."

Mr. G. A. BIDDELL (Ipswich) remarked that he would have liked a little information from the pounds, shillings, and pence point of view from the representative of the Yarmouth electric lighting undertaking. People would dabble in new things; but the question of cost would to a large extent affect their ultimate judgment. Speaking as a gas manufacturer, he strongly protested against the ratepayers of any town being called upon to find the money for speculation in electric lighting. If it did not turn out a success, it was an abominable thing that the gas consumers should be called upon to pay so much more for their gas. In support of this view, he would fight as long as he had power; but he would offer a fair field to any private company which came to the town.

Mr. E. C. SAYER (the Borough Gas Examiner of Ipswich) agreed that the Corporation ought not to speculate in anything that would cause them to lose a considerable amount of money. He had hoped that Mr. Carpenter would have given them some figures as to the profit or loss on electric lighting in Great Yarmouth, as that, to his mind, was the important point. In Ipswich, they first took up the question of electric lighting in 1894. A report was obtained from Professor Kennedy, who proposed a plant for 7000 8-candle power lamps alight at once (which would correspond to about 12,000 actually wired), and 44 arc lamps of from 500 to 700 mean candle power for public lighting. He estimated the cost at £28,000. Just about that time, the incandescent gas-light came to the front. It was tried in several of the street-lamps; and they were very pleased with it. He prepared a report on the subject, and submitted it to the Electric Lighting Committee. This report seemed to quite upset that of Professor Kennedy; and the £28,000 somewhat frightened the members. In September of 1895, they put up 879 single burner incandescent gas-lights, and were so satisfied with them that the number had been increased. It now stood as follows: 12 3-burner lamps; 16 2-burner; and 1156 single burner. Previous to the adoption of incandescent gas lighting, Ipswich had been the worst lighted town in East Anglia; but now it was the best. He had every hope that, with the introduction of the Bandsept burner, he would be able to do even better. He had had this burner tested on the photometer. It consumed 4 cubic feet of gas per hour, and gave an illuminating power of 100 candles; and this, he believed, would be increased to quite 120 candles when he obtained a proper mantle. He was obliged to use a short mantle; but Mr. Masterman, of the Denayrouze Light Syndicate, was about to send him some long mantles, from which he would get the full benefit of the 4 cubic feet of gas. In regard to electric lighting, if they had done nothing more, they had saved the town a considerable sum by waiting, because in 1894 Professor Kennedy estimated the cost of an installation at £28,000; but in August last year he stated that such considerable development had been made in the manufacture of glow lamps, that it was now possible to obtain lamps of from 200 to 220 volts as easily as a few years ago lamps of barely half that pressure could be procured. This would enable them to run the three-wire system with 420 volts instead of 210 volts, which would result in a large saving in copper. Therefore, by waiting two years, they had saved between £2000 and £3000. They had an Electric Lighting Provisional Order; and this would enable them to hold the field for two or three years longer, by which time advances might have been made in electrical science which would still further reduce the cost of the plant. Reverting to incandescent gas lighting, he said they had three Denayrouze burners in the town giving a light of something like 420 candles; and if he could get his Committee to go in for some of the Bandsept burners, he hoped to bring the present 50-candle power lights up to 100 or 120 candles by the aid of the longer incandescent mantle now being made for him.

Mr. E. W. SMITH (Chelmsford) agreed with Mr. Carter that gas managers ought not to estimate too lightly the effect that the competition of electricity would have upon gas lighting. In Chelmsford some years ago (he supposed about ten years ago), an Electric Light Company was formed. The effect on the sale of gas was to reduce it by something like 7 or 8 million cubic feet; and the rate of increase since that time had been very slow indeed. Notwithstanding that 6½d. per unit was charged for electricity, as compared with 4s. per 1000 cubic feet of gas at the present time, the Electric Light Company increased their number of consumers quite as much as the Gas Company did theirs. It must be admitted that the electric light did lend itself to some trades and purposes better than gas; and if this was so, it must, in course of time, have its effect on their industry. It was all very well for the gas suppliers in such towns as Ipswich to say they had no fear of the electric light; but when it did enter such towns, it would be found that it did affect the sale of gas.

Mr. CARPENTER, in reply, said he was pleased Mr. Chester had made a suggestion respecting the figures, as he might take the matter up—that was, to ascertain the equivalent of electric lighting in regard to the gas displacement. He had taken the figures generally, because he did not think it fair to compare an electric lighting concern in its infancy with an undertaking that was (say) sixty years old. They might be reminded of the time when gas shares were not worth quite as much as they were now; and possibly some of their early difficulties might be mentioned. In the case of the electric light undertaking, the capital consisted of borrowed money, and they had a big redeeming charge every year, which made a heavy clog for a small concern. Mr. Goddard had asked the meaning of the terms "shorts" and "overs;" and he explained it by saying that anyone who had to do with coin meters knew that people who consumed gas by them put a penny in the slot, and sometimes got ¾d. worth of gas and sometimes a 1¼d. worth. The adjustment of those "shorts" and "overs" meant a considerable deal. The difficulty he had referred to in the paper would be much more in the case of a concern supplying gas. Supposing, for instance, they had someone supplying them with free gas-tubes, and the company were responsible to the consumer, they would find the third party very awkward. As to troubles occurring with electricity, gas companies were not altogether free from them. Gas engineers, for example, were trying, and had been trying ever since he could remember, and his father a good many years before him, to get rid of the bugbear naphthalene; and this was not their only difficulty. Therefore, while in electrical systems there was sometimes loss of contact and fusing of wires, gas-works had a few things which might be set against them. This being so, where they had an electric lighting concern working alongside them, gas engineers had to be particularly careful what they had to say about it.

Mr. Frank Prentice (Ipswich) contributed the following account of his

EXPERIENCES WITH REGENERATIVE SETTINGS.

The settings referred to in this paper are seven sets of nines, 21 in. by 15½ in. through Ω retorts, each set heated by one furnace. The regenerators are formed by spaces on either side of the furnace 4 ft. by 1 ft. 6 in., divided by perpendicular tiles into three parts; the waste gases descending straight down the centre one, through perforated tiles, being merely baffled on their way. The secondary-air supplies ascend in two streams backwards and forwards four times on either side of the centre passage, and unite in a final chamber before passing actually into the combustion chamber. There are four regenerators; one at either corner of the setting, and four combustion chambers. These latter are 8½ inches wide. In each of these are five exits for secondary air, and five for producer gas; these being exactly opposite one another, and of similar size. From front to back they run 6 inches, 5 inches, 3½ inches, 2½ inches, and 1½ inches, and are all 1½ inches in depth.

Fires were started in four of these beds in September, 1894, and considerable caution was used in getting up the heats; so much so, that a full month passed ere any attempt was made to carbonize coal. When we did commence, only six-hour work was attempted; and with Newcastle coal, and 2¾ cwt. charges, 11,000 cubic feet of gas per ton was produced—the make per mouthpiece coming out at 6400 cubic feet per twenty-four hours. At this time the all-important fuel account was 17·5 lbs. of coke per 100 lbs. of coal carbonized. After a brief period, we adopted the usual five-hour charges. The make of gas per ton and the fuel account remained about the same; but the make per mouthpiece rose to a maximum of 7652 cubic feet per twenty-four hours.

After a few weeks, the heats began to fall; and a careful examination revealed the fact that parts of the settings had melted, and slowly run down, covering, as with a curtain, the producer gas exits. From this time, constant work was entailed in one or other of the beds, punching through this curtain, and so keeping the exits open. As this was at Christmas, 1894-95, when, owing to outside conditions, everything inside needed to be at its best, considerable anxiety was experienced. Everything suffered; and only wretched results were obtained. As soon as possible, the sets were let down, and the producer-gas outlets enlarged to their original size, by cutting away the furnace-arch, and doing the work from the inside. The outlets were now lined with Ewell bricks; and the slopes from the furnace to the combustion chamber were made steeper. In the August following (1895), these beds were started afresh, and worked during the winter, in addition to three fresh beds, which had been built in during the summer months. The winter was hardly on us when troubles began to thicken. To regulate the heats evenly seemed impossible. The bottoms, especially the centre one, got white hot, while the tops were not hot enough; and the whole trouble with the exit gas ports showed itself in a minor degree. Many of the hydraulic mains pitched right up, and had to be thoroughly cleaned, one side at a time; all the gas passing up the opposite side during the operation. Many schemes were tried. One was to keep water running on to the hydraulic mains; another to run water down the ascension-pipes; while a third, which gave us partial relief, was to work each tier of retorts for varying periods. Under this arrangement, the centre bottoms, before referred to, were charged as often as eight times in twenty-four hours. As a last resource, the centre bottom was discarded, and backs inserted in the rest. These measures to a large extent ended our troubles. But they were retrograde steps; and we determined on further experiments.

When the summer of 1896 came round, the first four beds, which had done 430 days' work, were reset with nines on a somewhat different plan, and the combustion chamber built entirely of Ewell bricks. When the time came to light them up, we again adopted six-hour work as a start, and produced 7000 cubic feet of gas per mouthpiece. As soon as we reverted to five-hour work, we found it well nigh impossible to keep up the heats; and an examination of draughts discovered the fact that our chimney only gave us 2½-10ths pull. To heighten the chimney was the next thing; and this was done to the extent of 20 feet—making its total height 72·6 feet. The draught rose to 4½-10ths; and we found the whole work much more under control. Innumerable experiments have been made on the draughts at various points; and we find that the best results are obtained when there is a slight pressure in the combustion chamber—a ½-10th at the top of the setting, 1½-10ths under the last retort, and 2½-10ths in the last flue. There is no doubt when everything is new and absolutely clear, such settings will work at a less pull than 4½-10ths; but without a fair margin to allow for partial choking, trouble is bound to come, and that probably at the most inconvenient time. During the winter, we again had to abandon the centre bottom, and insert backs; and this we did before difficulties accumulated too much.

These sets are still at work. They have done 400 days, and seem as good as ever. Determined to retain the ninth retort, we now have three settings, with the centre bottom inserted, all of them at work; and the local heating has been got rid of by the insertion of a brick-on-edge wall from the back to front of the combustion chamber, separating the secondary-air supplies from the producer gases until they have reached a point higher up in the setting, and above the bottom middle retort.*

On relighting a set, a most careful examination of the regenerators has always been found necessary. It is generally faulty, and short circuiting is taking place. An easy and certain method of deciding this point is to close all secondary-air inlets and open the dampers as wide as possible. The producer gas gets drawn back through the secondary-air inlets in the combustion chamber; and, owing to the great draught, streams visibly through any crack or hole, however small, into the waste-gas passages of the regenerator, which, of course, must be partially opened for purposes of observation.

A certain amount of trouble has been experienced by the passages round the retorts becoming more or less choked; uneven heating being produced. We now insert a steam-pipe, with a right-angled nozzle on the end, connected with a steam-hose. A few minutes suffice to thoroughly clean out a whole setting; and this without the heat being sensibly diminished, or damage done to the setting.

A most important point is the clinkering-doors. These must be absolutely tight. Experience has shown that it is possible to completely close the primary-air inlets, without reducing the heat of a set, owing to the leaky condition of the doors and surrounding brickwork. While referring to furnaces, it may be stated that the operation of clinkering has been generally performed once every forty-eight hours.

Glancing back through the record of this period, the question suggests itself, What gain do regenerative settings give over similar settings worked on the direct-firing principle? The average of a large number of tests put the fuel account at 16·6 lbs. per 100 lbs. of coal carbonized. I am aware this is a high figure, if the published statements as to what the fuel account should be are to be taken as a standard. The temperature of the main flue is, and has been, all but black—probably, under 1000° Fahr.; at any rate, not red enough to see more than a yard or two into it. This fact I take to be good evidence that the combustion has been fairly perfect; and it strengthens considerably the preceding figure. There is no doubt that some saving in fuel is effected, and that the life of the retorts is extended by this system; but, on the other side, there is the heavy item of initial expenditure.

Discussion.

The President remarked that the members were much indebted to Mr. Prentice for his paper. It was rarely they had a gentleman bold enough to chronicle his partial failures before a critical audience such as that. He therefore thought the author deserved their hearty thanks. He (the President) was, of course, intimately acquainted with the whole of the troubles Mr. Prentice had gone through, and had often sympathized with him in the difficulties under which he laboured.

Mr. R. G. Shadbolt (Grantham) said this was the kind of paper that was of the greatest value to an Association such as theirs. There seemed to have been a turn in the tide so far as technical papers were concerned; for, whereas previously they used to bring forward their successes and hide their failures, they seemed to be going in the other direction now, and brought to notice their failures as well as their successes. They had had examples of this during the present year; and it was a good sign, and one that was calculated to help them in preparing papers. The first question which occurred to him was only a small one; and there might be a local reason for it. It was this: Why was the retort section 21 in. by 15½ in. They were so used to going an inch at a time that the ½ inch seemed rather curious. The next point was the width of the combustion chamber. He rather thought the excessively narrow combustion chamber, added to the fact that, in the commencement of the experiment, the producer-gas exits and the secondary-air nostrils were brought into immediate contact, was responsible for a great deal of the melting and a large part of the difficulties originally met with. He did not agree that the coke question was the all-important one. In these days a few pounds of coke mattered very little compared with other features which were peculiar to regenerative settings. It was interesting to note from time to time the first experience of those who adopted the regenerative system of firing. Generally they found the retorts melted down, and an irregular heating of the settings, unless a setting was adopted that had been well tried and proved by lengthened experience. One thing that presented itself to his mind was that the extra ninth retort was scarcely worth the trouble it involved. Unless the works were large, better results would be obtained by discarding the ninth retort, and giving the additional room to the combustion chamber, than by trying to cram too much into the space. He thought this had brought about some of the difficulties which Mr. Prentice had so ably combated. There was one other danger he had noticed in works in various parts of the country; and that was the danger of converting the producers into huge direct fires. There was a little indication of this in the paper, where Mr. Prentice said that it was possible to close the primary-air

* The author here observed that they had done a little too much in connection with this question of the centre bottom retort being the hottest; it was now not hot enough. The walls here referred to would have to be lowered some 4 inches; and then he thought they would get an even heat throughout the settings. When he wrote the paper, he had not arrived at this conclusion.

supply; and yet kept the producer going. He (Mr. Shadbolt) thought there was danger in allowing too much primary air to be admitted to the producer, and so make it a direct fire instead of a producer; and it permitted too much grit to get into the combustion flues. He ventured to assert that Mr. Prentice had not yet reached finality in this matter; and, when he had solved the various problems that faced him, he would find that he had been amply repaid for the trouble he had taken.

Mr. W. R. CHESTER (Nottingham) thought with the President that Mr. Prentice was to be complimented on the courage he had shown in bringing forward a somewhat long and melancholy list of failures in connection with regenerative furnaces. Every one of Mr. Prentice's experiences had been met with before by those who had handled a regenerative furnace, and every one of them had had to be combated, and to a very large extent had been entirely got rid of. There was no necessity now for a gas-works to begin to experiment with regenerative furnaces, because there were many types in this country; and anybody who introduced them had only to avail himself of past experience to ensure success at the beginning. He noticed throughout the paper that the difficulties and troubles which had come in with the introduction of regenerative furnaces had created an impression in the mind of the author of the paper that "the game was scarcely worth the candle." If such an impression as this were to go abroad among those who had not adopted regenerative furnaces, he thought it would be detrimental to the interests of the gas industry, because there was no portion of gas apparatus in which there were greater capabilities of earning profit than in the retort-settings; and he (Mr. Chester) had come to the conclusion, after considerable experience, that anybody might avail himself of a sum ranging from 1s. to 1s. 6d. per ton of coal carbonized by substituting regenerative furnaces for ordinary direct-fired settings. This saving was made in three or four directions. In the first place, it was made up by the saving in fuel, by enabling a larger quantity of coke to be sold to the extent of 3 or 4 cwt., by the diminution in the amount of work necessary in attending to the fires, by the very large reduction in the cost of repairs, by the increased output on the same area of ground, and by the less capital cost per ton of coal carbonized during the lifetime of the settings. All these advantages came into operation where a successful system of regenerative furnaces was introduced. He noticed that among Mr. Prentice's experiences he had had the running down and melting of material. This was one of the very earliest experiences that manifested itself in connection with regenerative furnaces. It was so entirely got over by selecting the right kind of material, and by putting it in the right position, that they could get a durability and existence three or four times as much as the durability which Mr. Prentice had found in the case of his retorts. The production of 6400 cubic feet of gas per day, 17 lbs. of fuel per ton of coal carbonized, the arrangement of the centre bottom retort, and the durability of 400 days were all results which would scarcely be considered satisfactory in the case of a good class of ordinary direct-fired setting. While Mr. Prentice gained experience in connection with this matter, he (Mr. Chester) feared he had done so at considerable cost. The difficulties were only eliminated by the careful watching of one setting after another, so that they could be guarded against in reconstruction; but as settings ran for a long time, the opportunity of reconstructing did not come frequently enough in many moderate-sized works to enable the manager to get the full benefit of his experience. It was only in the case of large works where reconstruction occurred frequently that the weak points in connection with regenerative firing could be overcome; and he thought that engineers who were contemplating the introduction of regenerative firing ought first to make careful inquiries as to what were the possibilities with some of the best systems in operation. As to Mr. Prentice's reference to having obtained a fairly perfect combustion in his main flue, he (Mr. Chester) thought his combustion had been too good in all probability. The short-circuiting in the regenerator flues had affected the combustion. It had been too complete; and if Mr. Prentice were to analyze the exit gases going away in the chimney, he would find an enormous excess of air among them, and, of course, this had a tendency to lower his heats and his results. Successful working of regenerative furnaces could only be realized by making careful analysis of the gas in the exit-flues, so as to limit the quantity of air to the minimum, and so as to ensure that no more air was allowed to pass into the setting than was absolutely necessary for complete combustion.

Mr. W. D. CHILD (Romford) observed that the few years' experience he had had in the working of regenerative furnaces had led him to think that too much attention was given to the question of the saving of fuel. With the very low price of coke and the difficulty they had in selling it, he did not think that should be the primary object. Mr. Chester had named various advantages which came far before the saving in coke—such as the saving of labour, and the wear and tear of the retorts. By working the settings at high heats, they would get a large yield per ton of coal; but if they were content to work with the heats to which they were accustomed in ordinary firing, they might expect the retorts would last a great length of time. He had worked a setting of retorts 570 days without altering them at all. There were many advantages in running retorts over a long firing, without dropping, by keeping to a moderate heat tha would yield 10,600 or 10,700 cubic feet of gas from Durham coal He was then able, by repairing at a cost of about £4 or £5, to run the setting another 300 days. If gas managers would be content with the saving in labour and the same production per ton of coal as in the ordinary settings, they would obtain great advantage from regenerative firing. He thought the question of regeneration could be overdone; and he said so in a paper he read at Yarmouth some three years ago. He was content with one simple line of flues to obtain all the regeneration he required. In this way, they might construct a setting, with little danger of short-circuiting in the flues, and also of waste.

Mr. J. E. BUCKLE (Woodbridge) remarked that the author stated that many of the hydraulic mains pitched right up, and had to be thoroughly cleaned. He was curious as to how these were cleaned while the retorts were in use.

The PRESIDENT: They are through retorts.

Mr. A. GRAHAM (Mansfield) inquired the area of the chimney.

Mr. H. WIMHURST (Sleaford) said his experience of regenerative settings had been one of unbounded satisfaction; and he had not had the difficulties described by Mr. Prentice. Owing to the lapse of time, the settings were on a more improved principle; and they had only beds of sixes. By doing away with the centre retort, a larger combustion chamber was obtained; and one could work in a much easier manner. As to the fuel account Mr. Prentice mentioned 16·6 lbs. per 100 lbs. of coal carbonized. In his (Mr. Wimhurst s) case, it was between 12 and 13 lbs. Their total coke sales last year were 10 cwt. per ton of coal carbonized. Neither he nor his men would like to go back to direct firing. The regenerative settings worked much easier; and the men had only to clinker twice a week.

Mr. PRENTICE, in replying, said he did not know why the retorts were of the size named. It was the size they had used for many years; and therefore they continued to keep to it. Mr. Shadbolt had suggested that perhaps he (Mr. Prentice) had too much primary air. If he had, he did not think the flues would be so dull. It was also suggested that the combustion chamber was very narrow. The retorts were in sets of nines, and 10 ft. 3 in. centres through the arches; one could not get any more space where they were that size. As to the melting down being due to the chambers being too small, he did not think that was the case, because since they had renewed the bricks with Ewell bricks, there had been nothing of that sort. They had tried combustion chambers giving 3 feet clear; but they did not find any material improvement. When they had the melting down, only ordinary common fire-bricks were used; and he did not think they would stand the heat of the combustion chambers. The exit-ports were still opposite one another; and now they had no trouble in that way. Mr. Chester said there was no occasion for anyone experimenting on these things. In fairness to themselves, he ought to say that they did not just put up something that they thought would do; but they adopted what they considered would be an efficient setting. The settings were not put in by the Company; and the difficulties were not due to them. The exit gases had been analyzed most carefully; and he had never found an excess of air. Mr. Child thought the saving of labour with regenerative settings was very great; but their experience at Ipswich did not agree with this. They had just as many men. They had less firing; and one man did more fires than he did under the old system. But the spare man was found to be necessary for dealing with the larger quantity of coke that was produced, and the distance it had to be wheeled out into the yard. One gentleman wanted to know how they cleaned the hydraulic mains while the settings were in use. They shut the valve off the main, removed the bridge-pipes, and blocked the ascension-pipes on the side they had to deal with. They could then take off the top of the main, open the large plates and cocks they had underneath, and so clean it out—working the whole of the retorts from one set of pipes, and through the hydraulic main on the other side. As to the chimney, it was 4 ft. 6 in. by 2 ft., and 76 feet high, with 4½-inch draught; and before they lengthened it, they had only a 2½-inch draught. As to the fuel account, they had made desperate efforts to get it down, but had not been successful. As to clinkering, they used seaborne coal, and found that forty-eight hours was the longest they could comfortably run without clinkering.

The PRESIDENT remarked that he was not at all satisfied with 10 cwt. of coke sold per ton of coal carbonized. They had coke firing on the direct system, and were able to sell more than 10 cwt. of coke per ton of coal. There might, however, be other collateral advantages in regenerative firing. They had looked for something better, and were guaranteed something better; but they had not realized it.

VOTES OF THANKS.

On the proposition of Mr. CHESTER, seconded by Mr. CARTER, a vote of thanks was passed to Messrs. Carpenter and Prentice for their contributions to the proceedings.

The PRESIDENT moved, and Mr. CHILD seconded, a vote of thanks to the Mayor and Corporation for the use of the Town Hall for the meeting.

The motion was heartily agreed to; and this concluded the business proceedings.

The members then gave themselves up to pleasure for the remainder of the day. The first move was to the offices of

the Gas Company, where luncheon had been provided by the generosity of Mr. Biddell, whose thoughtfulness and kindness were much appreciated by those present.

VISIT TO THE GAS-WORKS.

Conveyances next transferred the members to the Company's works, where nearly an hour was spent in inspecting the plant. Some curiosity was naturally manifested in the bench of regenerative settings which had given so much trouble, and which had been the subject of discussion at the meeting. The working of the hydraulic machinery by which coal and other material is raised from boats in the Orwell was watched with much interest; but the object which riveted the attention of the visitors for some time was a large gasholder which is being constructed by Messrs. S. Cutler and Sons, and a short description of which will be found in our "Miscellaneous News" columns to-day, p. 591.

TRIP DOWN THE RIVER ORWELL.

For the afternoon a great treat was in store for the members. The President had chartered one of the G.E.R. steamers—the "Suffolk"—and at about 2.30 the members embarked, and had a delightful trip down the Orwell and round the Cork Lightship, reaching Ipswich Harbour again about 5.30

THE DINNER.

On the invitation of the Chairman and Directors of the Gas Company, the visitors dined in the evening at the Town Hall; their number being augmented by several local gentlemen and personal friends of the President. Among the guests were the Deputy-Mayor (Mr. G. F. Josselyn) and Mr. Corbet Woodall, the President of the Institution of Gas Engineers. The usual toast-list was gone through; and the Christchurch Glee Singers contributed largely to the evening's enjoyment.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Berwick.

The Seventy-third Half-Yearly Meeting of this Association was held at Berwick on Thursday. Mr. H. RUTHERFORD, of Aberlady, the President, occupied the chair.

The PRESIDENT delivered an address, in which he said he was glad that since their last meeting they had had no cause to mourn the loss by death of any of their members. But there was one death which he could not help referring to—that of Mr. R. Mitchell, of Edinburgh, who, although not a member of their Association, attended some of their meetings, and was always made welcome. He was sure they all sympathized with Mr. Mitchell's family in their sad bereavement. But there was a loss which the Association would have to sustain, by the removal of their esteemed and respected Secretary and Treasurer (Mr. J. Smith, late of Selkirk), who had been fortunate in securing a higher position in the gas world, but out of their district. He was sure that they, as an Association, congratulated him, and wished him all success and prosperity in his new situation. They were all living in an age in which they must try to advance in knowledge—and that at a very quick pace, or they would soon be left very far behind. They were also living in an age in which they must economize. He thought he could venture to say, without fear of contradiction, that gas managers, as a rule, had kept pace with the speedy growth and development of their profession for the last thirty years, or he might say from the days of Flintoff, who went about the country before that time lecturing on gas questions. The old veterans, as they were termed in those days, the founders of their Association—the late Mr. Young, of Dalkeith, Mr. Clazy, of Kelso, Mr. Scott, of Musselburgh, Mr. Robson, of Selkirk, and their friend, Mr. Robb, of Haddington, who, they were glad to know, was going about still, hale and hearty—were all present at a public meeting held in the Town Hall of Musselburgh, ready to maintain that Flintoff was wrong in his statement regarding the quantity of gas which he could take out of coal. He had not any of Flintoff's statements in his possession; but he had no doubt that he was the first to open the eyes of the gas managers of that time. They had progressed a great deal since then; and he had no doubt they would still do so, notwithstanding the enemies they had in electricity, oil, &c. At their last meeting, in Haddington, Mr. Blair, their then President, said that, when he went to Haddington, his works were in a dilapidated state. There were, he feared, some works still in this condition. But if gas-works were not always what they would like them to be, he must say that in many buildings in their towns they found the gas-fittings in a very bad state indeed. In too many cases, they would find the gas-fitters were as ignorant of the principles of gas-fitting as were their customers. He did not altogether blame the fitters; for in too many instances they were screwed down to the lowest charge for their work, and it was no wonder, under such circumstances, that they did not study the principles of their trade. As he had said, they lived in an age of improvement. They knew of the improvement that had of late taken place in the sanitary condition of their dwellings; and they knew that the plumber of to-day had to be registered as a practical plumber before he was allowed to fit up those sanitary arrangements. Why, then, should not the gas-fitter be registered, in the same way? He was glad to observe that the authorities of the city of Boston, U.S.A., were bringing in a scheme, providing that no gas-fitter should be allowed to carry on his trade in the city unless he held a licence from a Board of Examiners. He would go farther, and say that it was not only plumbers and gas-fitters who should be registered, but that those who made the plans for buildings—architects and clerks of works—should also be able to know whether gas-fittings were right or wrong, and should not be obliged to take the advice of those who were in charge of the gas supply, as they often did. If they were able to provide proper interior fittings, there would be fewer complaints about bad gas. An old lady once accosted him as they were coming out of church, and wanted to know why he gave such good gas to the church, which was always superior to what he supplied to her house. He told her that the gas was the same, but that the church was fitted up properly, whereas her house was not. She had since remedied the defect. County councils had full power over the water supply to houses in their districts. They told, in detail, what size and weight of pipes, cocks, &c., they would allow to be put in; and if the work were not done according to their instructions, they would cause the whole of the fittings to be removed, and others put in to the satisfaction of their superintendent, before the water would be turned on. He did not say that gas companies or corporations should have the same power, because householders were assessed for water whether they used it or not, while they only paid for the gas which they burnt; but he felt that some supervision would be advisable. He would like to refer them to a pamphlet issued by Mr. D. Macfie, of Messrs. J. Milne and Son, Limited, containing a lecture which he delivered to the plumbers of Edinburgh, on "Gas Control from Meter to Burner." The "JOURNAL OF GAS LIGHTING" said of that lecture: "The plumbers were an attentive audience." And so they might be, for they learned things which had never been inculcated in their hearing before. It was much to be wished that every plumber in the country should have a copy of the pamphlet always at his elbow. There was one question in regard to gas matters which he would like to bring before them for their opinion. He had two houses of the same size, supplied with gas by the same main, with the same size of service-pipe and meter—3-light wet—with the same pressure at the burners, and much about the same quantity of gas consumed in each house; but one meter was always going wrong for want of water, while the other worked all right, and only required watering three times a year. Where did all the water go to which was put into the first meter? It did not affect the pipes in any way; nor did it go into the overflow box of the meter. He took out the meter, with the intention of sending it to the maker to see what was wrong with it; but unfortunately, while it was being taken home, it slipped off the man's shoulder and was broken. He examined the interior of the meter, but could see nothing wrong with it.

Mr. W. BLAIR (Haddington) said he thought Mr. Rutherford was deserving of a very hearty vote of thanks for the subject-matter he had brought before them. Although there might not be anything particularly new in it, he thought it was only right that they should be reminded of some of the old lines that lay in their way. Like him, he was very much indebted to Mr. Macfie for the lecture he gave. Their President had made reference to the plumber. If they could get plumbers thoroughly educated to the requirements of gas-fitting in houses, there would be fewer complaints about bad gas. But if they could get architects properly educated, they might expect to get the full illumination out of the gas consumed. When he went to Haddington, a large building required to be re-constructed. He told the architect it would require a 50-light meter, with a 2-inch service. The architect had provided for a 5 light meter, with a 1-inch service. He informed the architect that until the building was properly fitted up, no gas supply would be laid on. The architect's reply was that a certain building in Glasgow, of the same size, had a similar provision. Now it happened that he (the speaker) had had to do with the fitting up of that particular building; and he told the architect that it was served by a 6-inch pipe. So that it was not always the community they had to blame for complaining. He had much pleasure in moving a hearty vote of thanks to Mr. Rutherford.

Mr. W. B. M'LUSKY (Kelso), in seconding, said he had appreciated Mr. Rutherford's address very much, and especially his practical remarks on gas-fitting. He had found such cases as had been spoken of; but he had also seen instances in which the gas company, or their officials, had been at fault. Such cases were easily rectified; the others were not so easy, because no one was prepared, after laying pipes, to relay them. He had, in Kelso, one striking instance, where a gas-engine of 19 nominal horse power was put in. The local setters of the engine told him that it was useless to lay on a 2-inch service-pipe to it, with a 1-inch pipe to the bag. He found that it would have required a pressure of 23-10ths to work the engine, with an additional 1-10th gained by altitude. The proprietor declared that the engine was the same as one erected in Leith, and that the fit-up was in every detail the same; but he was quite prepared to make the necessary alterations if he could prove to him that there was any difference in the Leith engine. They visited Leith in company; and they found that there they had a system of supervision which was very complete. Mr. Linton, who was then at Leith,

did not allow any outside party to interfere. There was a 6-inch main in the street; and Mr. Linton had re-laid 18 yards of it with a 12-inch main, thereby making a reservoir. He took a 4-inch pipe off the reservoir, and carried it right to the engine, with a 3-inch pipe to the bag. The engine in Leith was working perfectly to its power, with 10-10ths pressure at the meter-inlet. This case bore out Mr. Macfie's remark that gas supply would never be right unless there was complete supervision from meter to burner, as well as from retort to meter. He had found many cases corresponding to that of Mr. Rutherford, of a meter requiring a lot of water. It might, perhaps, be beyond his ability to offer any assistance in the matter; but he believed that it was due to evaporation. The one meter might have been situated in a much warmer place than the other. He had found draughts causing condensation, and had been astonished at the quantity.

Mr. J. M'Laren (Duns) said he had two instances in Duns, relating to fittings. In one there was a 2-light meter, with six burners off it. The plumber sent for him, and said they were not getting a supply of gas. There was a ¾-inch connection; and from the outlet to the first 3-light gasalier, there was a ½-inch pipe, and beyond that a ⅜-inch pipe. Larger pipes were put in, and there was a good supply now. In the other case, they had a church in which there was a 20-light meter. One Sunday this church was left in darkness. He was sent for on the Monday morning, and told that the fault could not be with the meter, because it had been sent to the makers in Edinburgh about ten years before; and they returned it with the message that it was fit for the lighting of the church. There were 204 burners in the church; but all of them were not lighted at once. He took the meter out, and put a temporary connection on; and meanwhile there was a sufficient supply of gas to the building. His Directors authorized him to cut off the supply until a proper meter was put in.

Mr. Blair thought there was no doubt that the meter was working beyond its capacity. About the difference in the watering of meters, he might say that there was the question of draught, or temperature, or the position of the meter. He had come across meters, even in the same house, some of which needed water to be taken off, and others of which required water to be added, almost every survey. This, he supposed, was owing to the draught, or current, of air in the place.

Mr. J. Richmond (Dunbar) remarked that there were instances in which the fittings and the supply of gas were good, but the burners were bad. In Dunbar, they supplied burners free. He would like to refer to the blackening of mantles in incandescent gas lighting. His belief was that it was due to a defect in the bunsen burner, which did not consume all the carbon particles.

Mr. D. Macfie (Edinburgh) said it was not his intention to have made any remarks; but having been called upon, he felt that he must say that, while larger powers to deal with fittings had been spoken of, he thought that until they used the powers they already had, it was not right to complain of the defects of plumbers and architects. He honestly believed that gas managers could always find out for themselves what was faulty; and, having done so, it was their duty to put the matter before the consumer, and to say that until the defect was remedied they would listen to no complaints. As to the blackening of mantles, he was inclined to agree with Professor Lewes that this was largely due to the faulty construction of the burners. He held, also, that mantles might be blackened by the gas being burned at a pressure of less than 8-10ths or 10-10ths.

Mr. M'Lusky pointed out that nothing had been said about bye-pass or pilot lights. He found that it was not advisable to adjust the pilot light when the bunsen flame was not burning. He tested the pressure at the place where the burner was to be fixed, at a time when as many burners were going as were in use. He employed a screen for ascertaining the height of the flame before the mantle was put on; and he was able to regulate the height to suit the pressure at which the light would burn. He found that a number of burners had to be rejected because of the key-way being defective, and the pilot light increasing the flame from an eighth to three-quarters of an inch, and not being capable of being pinched down. In the case of burners without a pilot light, he had seen a very poor light caused by too much gas being supplied; the rush of gas cooling down the flame. He had found incandescent burners passing 3½ cubic feet of gas per hour giving a reduced light, while 2¾ cubic feet of gas would give an efficient illumination.

The President thanked the members for their vote to him, and for the discussion which had taken place on the remarks he had made. They were aware their friend Mr. Smith (late of Selkirk) had been their Secretary and Treasurer for a number of years; but as he had now received an appointment out of their district, it was necessary for them to appoint a successor. It would not, however, be out of place for him to ask them to give Mr. Smith a hearty vote of thanks for his services. He had done all in his power for the prosperity of their Association. They congratulated him on his entering upon a new sphere; and he was sure that, if at any time Mr. Smith should find it convenient to attend any of their meetings, they would give him a hearty reception.

Mr. M'Lusky, of Kelso, was then unanimously appointed Secretary and Treasurer.

It was resolved, after some discussion, that the meeting next April should be held in Edinburgh, and that the September meeting should be held in Duns.

The members and their friends afterwards dined together in the King's Arms Hotel, after which the customary toasts were drunk. The day was by this time far advanced; and instead of an organized excursion, the members enjoyed a walk through the ancient town, the walls and ramparts of which were a source of interest to the visitors. Mr. S. Black, the recently appointed Manager of the Berwick and Tweedmouth Gas Company, also kindly showed over his works those who cared to cross the River Tweed to Spittal, where they are situated.

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting at San Francisco.

(*Continued from p. 531.*)

A paper on "Municipal Control; being a Legal, Commercial, and Political Review of the Question of Municipal Ownership of Semi-public Enterprises of Profit," was read by Mr. C. W. Quilty, of San Jose. The primary function of a government is rule, law, regulation, which suppose the highest disinterest, in contradistinction to ownership, which implies the highest self interest. Municipal government and municipal ownership expressed diametrically opposed propositions; and it was never intended that their government should be interested in properties of a commercial nature. This might be done under Imperial Government, but was foreign to their republican form of government. In several cases, which were quoted in detail, it had been tried; but the results did not tend to the public benefit. And if carried to the extreme, it would kill competition, choke development, destroy enterprise, and make the inventive, grasping, active, aggressive American, a listless, helpless dependent of the State. Dealing with the commercial aspect of the question, the author showed that there was neither profit or protection to the mass of the citizens in the conduct of municipal enterprises. The owners of property might be benefited, but not the consumers. Under the present system, the powers of law could be invoked; but owners could not regulate themselves. Taking another point of view, the author eloquently advocated the right of the individual to the ownership of all that he created, produced, or legitimately acquired. Capital was the representative of the accumulation of effort, irrespective of the form in which it was invested, and gas-works capital was the same as that represented by gold, real estate, buildings, or anything else. So why should government seize the one, and leave the others? He contested the principle, apart from any question of expediency or desirability, in certain cases. Government ownership also destroyed the healthy stimulus of competition, which had and was constantly lowering the rates of all kinds of public service. As to the political phase, his remarks would be readily appreciated by everyone conversant with modern American politics. With short tenure, and the ever increasing struggle for office, the successful candidates immediately set about perpetuating themselves by preparing for re-election, recouping themselves for expenses incurred, and providing for their friends and followers. Fraud, political corruption, and high taxation were the story of every city in the Union. In support of this statement he quoted from two works by Mr. M. J. Francisco. The remedy for the abuse of the use of semi-public utilities by private citizens was to be found in municipal control, which he had shown to be a different thing from ownership. He was in favour of controlling the rates of dividend to be paid by gas companies, as was done in England in recent years.

Mr. C. M. Converse, of San Francisco, read a paper descriptive of the working of some Weber regenerative furnaces in settings of sixes. These were in use for 3½ years continuously, and were let down carelessly, without precaution, under the belief that they were worn out. As it turned out, they might have been used some time longer. The make was 11½ million cubic feet of gas per retort, and the consumption of fuel 25½ per cent. of the coke made. The bench was very gradually heated up, and it was surprising how little air inlet was required for the primary; but he gave a liberal supply for the secondary. For scurfing, he used a row of tiles laid along the bottom of retort, to convey the air to the back. It was necessary to use the same precaution in letting down as in taking up.

Discussion being invited, Mr. Gregory said he was able to work with one square inch area for the primary, and three square inches for the secondary, air inlet. The President said that the adjustment of the air supply to the regenerative furnace was a very delicate matter, and that previous experience with open fires was of no use. Mr. Petch recommended the system for small works, as it was more easy to bank up at night than with the open furnace. Working under these circumstances, his settings lasted for four years and even more. Mr. Russell said a great deal depended on the care used; but a make of 7 to 8 million cubic feet of gas was a good average for the life of a retort.

Mr. D. R. Russell, of St. Louis, Mo., followed with a paper on "Recuperator Benches for Coal and Coke Firing." There should preferably be a depth of 5 to 6 feet from the bottom

retort to the ashpan, and an arch 7 to 8 feet wide; but it was possible to do with less. All flues for waste gases should be so arranged as to be easily cleaned; and all joints should be perfectly tight, so as to avoid leakage of air. The ashpan should be about 18 inches wide by 5 feet long; and a system of water pans should be arranged step-fashion at the front. With some kinds of fuel a jet of steam was preferable. The minimum depth of fuel at any time should be 2 feet. The pits in front should be 9 feet wide, and not less than 6 to 7 feet deep; but it was possible to manage with 4 feet depth. With beds of sixes, half-depth was preferable, as when they went to the expense of full depth furnaces it was desirable to put nine retorts to a setting. The half-depth furnaces were popular because it was possible to adapt them to ordinary arches. Coke fires required a thorough clean out about once, and coal fires twice a week; and with the latter, it was usual to fire with coke only for one day in the week so as to burn out soot, &c. The primary air supply should be carefully checked, so as to avoid the formation of carbonic acid in the furnace. A table was exhibited, showing the actual saving of fuel by the substitution of gaseous for solid firing in works making 8½, 17, 34, and 68 million cubic feet of gas per annum respectively. From information regarding local coals, he believed that it would be possible with a half-depth bed of sixes to make over 50,000 cubic feet of gas per day, and a consumption of coke not exceeding 30 per cent. of the total; or with a full-depth bed of nines, to make over 90,000 cubic feet, with a consumption of 20 per cent. With coal as fuel, the consumption would not exceed 25 per cent. of the weight carbonized in the first case, and 11 per cent. in the second. For a make of 8 millions per annum he would advise a semi-recuperator bed of four, and a second of three retorts; for 17 millions, one of six and a second of four; for 34 millions, two of six, and a third of four; and for 68 millions, five of six, or three full-depth of nine retorts each. The beds of four could be fitted in an arch for a bed of six, so as to admit of easy extension at a future time. For larger works than 68 millions, he recommended the full-depth furnaces.

In the course of the discussion, Mr. Britton said that at one time it paid him to use coal as fuel, but at present, when coke was a drug, owing to the importations from England, there was no inducement to do so. He now saw there was to be a tariff of 3s. 3½d. per ton on all coal imported into California. Mr. Jackson also used coal as fuel, and with very good results, when the price of coke was high.

The next communication was one on "Clay Retorts," by Mr. O. B. Weber, of New York. After giving some very interesting historical information, the author quoted an experiment he had tried with a view of testing the permeability of ordinary retorts. A retort that had been used for 4½ months, and was thickly coated with graphite, was selected; and at pressures below 20-10ths, the loss of gas was inconsiderable. But it increased rapidly when the pressure was raised.

Mr. F. Foveaux, of San Francisco, followed with a paper entitled "Gas as Fuel," in which he pointed out the advantage of introducing gas-stoves, and thought if it was worth while to spend £6 or so in laying mains to supply an additional lighting customer—which almost any gas manager would do—it was also worth while to put in a good gas-stove where it would be likely to be used. The cost would not be greater, and the returns more certain and profitable. He proceeded to treat on the necessity for proper ventilation in connection with gas fires or heaters; and he exhibited drawings showing independent supplies of air from outside the apartment, and flues for the escape of the products of combustion. He discouraged attempting to utilize waste heat from cooking-stoves for warming water, and showed several patterns of water heaters suitable for circulating apparatus. He preferred a separate overhead tank, to a direct connection with the town water supply, and entered very fully into various details of construction of his apparatus.

A paper directing attention to the advantages of the card system of book-keeping, in which boxes containing loose cards systematically arranged are substituted for bound indexed books, was next read. Several members spoke highly of the plan. Mr. Jones was keeping an index of over 25,000 meters at San Francisco in this manner; and he found it so satisfactory that he was extending it to other departments of his business. Other members also spoke very favourably of it, in connection with any system involving a large number of separate items; especially those requiring frequent alterations or additions, as fresh matter of any length could be added without interference, and closed accounts could be taken away and stored for reference, or otherwise disposed of.

The report of the Editor of the "Wrinkle Department," Mr. M. C. Osborn, was subsequently presented. The first item was an arrangement for carrying a gas-meter and a few tools on an ordinary bicycle, intended for the use of meter-fitters. Another was for a plan of testing main-pipes by means of steam. A cover is secured by a suitable clamp at each end of the pipe, and steam admitted through a connection tapped into one of the covers. Then there was a proposal for attaching a tee-piece, with a long horizontal arm extending to the centre, to one of the rising pipes of a gasholder, so that the gas from the inlet might not pass directly to the outlet, but be well mixed with the contents of the holder before reaching that point. Another ingenious idea is an indicator for street syphons, or for those about the works. A second pipe is introduced by the side of the suction-pipe, terminating 3 inches or so below the bottom of the gas-main, and is connected to a street-lamp or some light in use. The gas supply to this light will be stopped, and the light extinguished, some time before the accumulating liquid can flood the main. A useful indicator is thus afforded, which is particularly suitable for gasholder syphons. Two "wrinkles" referring to the scrubber, consisted of a small cistern with a ball-tap for maintaining a regular head of water at the inlet-water supply, and a glass cylinder containing an ordinary hydrometer at the outlet, by the indications of which the water supply can be adjusted as desired. A soldering-iron furnace, with hinged foot-plate in front, was described. The weight of a soldering iron placed in the furnace depresses the foot-plate, which is connected by a crank arrangement with the gas-tap, and thus turns up the gas; and when the tool is withdrawn, the foot-plate returns to its previous position, and the supply of gas is reduced.

(*To be continued.*)

NOTES ON THE ENRICHMENT OF COAL GAS.

(*Continued from p.* 530.)

Enrichment by Cannel Gas.

This method of enrichment was exclusively used for years, and would now probably be enjoying an almost complete monopoly in coal gas enrichment in this country had not cannel become scarce and costly. The rich coals and shales commonly spoken of as cannel vary greatly in their gas-producing quality. Some are little superior to good Durham gas coal; and some few yield at least 15,000 cubic feet of 38-candle gas per ton. The results of tests of the gas-making properties of a very large number of cannels are given in Newbigging's "Handbook for Gas Engineers and Managers." The following figures show the value of a few cannels, which either have become well known or are of extraordinary merit:—

—	Yield of Gas. Cubic Feet per Ton.	Illuminating Power. Candles.	Pounds of Sperm per Ton of Cannel.
New South Wales	15,300	38·43	2126
Boghead shale	15,750	38·39	2073
Cannel from the United States.	11,954	46·75	1916
North Wales	15,305	30·62	1625
Lesmahagow	12,310	34·53	1457
"	11,934	30·54	1247

The last variety—Lesmahagow—of which the results of two perfectly independent tests on rather different samples are given, has been taken as typical of an ordinary cannel of good quality. One ton of Lesmahagow cannel has been assumed to have an intrinsic enriching value equivalent to that of 50 gallons of carburine (0·680 sp. gr.) from American petroleum. This assumption has been made with a view to expressing quantities of other enriching materials—such as carburine—in terms of a standard material. Lesmahagow cannel has been arbitrarily chosen as the standard material; and ratios based on empirical results have been deduced for the purpose of expressing what purports to be the intrinsic enriching value of quantities of other enriching materials in terms of Lesmahagow cannel. There is no natural basis for the choice; and were it essential that such a standard should be chosen, it would have been better to have selected a hydrocarbon of invariable composition. However, Lesmahagow cannel has now a certain prestige as a standard of enriching materials; and quantities of them are frequently expressed in their "equivalent" number of tons of Lesmahagow. This equivalent is not an absolute expression of the intrinsic illuminating value of the other materials, nor even of the results actually achieved by them in each case; therefore figures and comparisons based upon it must be accepted with every possible reserve.

Comparatively few analyses of cannel gas of which the photometrical value has been accurately ascertained have been published. The following will serve to show roughly the variation in composition of the gas with the candle power:—

—	Candle-Power.	Hydrogen.	Methane.	Illuminating Hydrocarbons.	Carbonic Oxide.	Nitrogen.	Carbonic Acid.	Oxygen.
Newcastle cannel, 1853*	34·40	25·82	51·20	13·06	7·85	1·51	0·13	0·43
Glasgow gas, 1882†	27·00	39·18	40·26	10·00	7·14	3·07	0·29	0·06
Westminster gas, 1876‡	21·00	41·72	41·88	8·72	4·98	2·71	..	..

* E. Frankland. † P. F. Frankland. ‡ Humpidge.

A great number of analyses of cannel gas may be found in Humphrys' "Chemistry of Illuminating Gas." From the above, it will, however, be evident that rich cannel gas contains more methane and less hydrogen than coal gas; while the percentage of hydrocarbons is considerably greater. The deleterious con-

stituents are found in the same quantity, and carbonic oxide in slightly greater amount. Even if the illuminants proper existed in only the same proportion as in coal gas, the higher proportion of methane would give cannel gas a greater illuminating power. Therefore, in some degree, the higher value of cannel gas must be ascribed to its greater content of methane. In many analyses, a certain quantity of higher paraffins have doubtless furnished a portion of the products of combustion by which the proportion of methane was reckoned; and thus the figure given for methane has been too high. But with due allowance for this error, there remains a higher proportion of methane than coal gas contains. Owing to the great variations in quality of cannel gas, and the great diversity of composition of so-called cannels, it is impossible to give a generally applicable classification of the hydrocarbons in cannel gas. Probably most of the hydrocarbons of the paraffin series are represented among the products of the carbonization of cannel—the heavier members in the tar, and the lighter in the gas. The proportion of methane and other paraffins generally rises with the candle power of the gas. The other hydrocarbons of cannel gas are chiefly ethylene and other olefines.

Now paraffins and olefines are essentially low-temperature products; and it is noticeable that the amounts of aromatic hydrocarbons and hydrogen, which are the ultimate products of carbonization at very high temperatures, are small. But retorts used for carbonizing cannel are heated to quite as high a temperature as for coal; and therefore lower heats in the settings cannot account for the greater abundance of low-temperature products in cannel gas. The volume of gas obtained from a given quantity of cannel is generally considerably greater than that from the same amount of coal; and therefore the cannel gas must *cæteris paribus* pass away from the retort at a greater rate than coal gas does. It is thus exposed for a less length of time to the intense heat of the retort, while the greater gas production abstracts more heat from the latter. Thus, even if the retort be initially at the temperature of a coal-gas retort, it soon acquires a considerably lower temperature. Many gas managers are in the habit of firing their cannel retorts more vigorously than the remainder, in order to avoid the effects of the greater abstraction of heat. But most of the gas is produced within a comparatively short period; and during that time the actual temperature of carbonization is brought very low. Thus paraffins and olefines always survive to a greater extent in cannel gas than in coal gas. The different conditions which automatically supervene during the carbonization of common coal and cannel therefore afford an explanation of the formation of different classes of hydrocarbons to which the illuminating powers of the gases produced are chiefly due; and it does not appear necessary to go further and consider differences between the constituents of cannel and coal. With carbonization at high heats, these differences probably affect the quantity rather than the nature of the gas produced.

The common practice of carbonizing cannel at very high heats is a tacit admission that the production of high-temperature products—*i.e.*, aromatic hydrocarbons—is more economical than that of paraffins and olefines, and that the gas from a ton of cannel abstracts more heat from the retort than does that from a ton of coal. The sperm value of the gas from a ton of cannel has been observed to increase with a rise in the heat of carbonization, and this notwithstanding the fact that the total volume of hydrocarbons becomes less. But the hydrocarbons formed at high are better illuminants than those formed at low temperatures. Olefines are better illuminants than paraffins; and aromatic hydrocarbons better than olefines. In no cannel gas formed under ordinary working conditions, however, do aromatic hydrocarbons preponderate and supply the major part of the illuminating power of the gas, as they do with ordinary coal gas. Owing to the comparative freedom of cannel gas from the readily condensable aromatic hydrocarbons, it seems likely that if it has once been thoroughly cooled in the condensers, it will afterwards lose few of its illuminating hydrocarbons on exposure subsequently to a low temperature. The illuminating power of cannel gas appears to be due chiefly to methane and ethylene, and their homologues of high vapour tension. The homologues of low vapour tension are found in cannel tar, and make it objectionable to the tar distiller. Cannel gas is, thanks to the nature of its illuminating hydrocarbons, comparatively little depreciated by exposure to low temperatures. It has in a very marked degree the quality which is commonly spoken of as "permanency."

The illuminating hydrocarbons of cannel gas, for the most part, are very soluble in many hydrocarbon liquids. Among these is tar. That condensed from cannel gas soon becomes saturated with the illuminating hydrocarbons of the gas; and thereafter it ceases to be a solvent of them. Nevertheless the removal of the gas as quickly as possible from contact with its tar is very desirable. The practice of carbonizing cannel and common coal in neighbouring retorts which feed one hydraulic main, has the disadvantage of exposing the cannel gas to contact with coal tar as well as its own. The coal tar can thus dissolve hydrocarbons from the cannel gas in lieu of, or in addition to, those it absorbs from coal gas. The solution by tar of a portion of the hydrocarbons of the gas depreciates the illuminating power. Messrs. Young and Glover recently (see *ante*, p. 16; also *post*, p. 588) expressed views similar to those here enunciated; and in order to avoid the depreciation of the cannel gas, they have proposed that the carbonization of the cannel and the condensation of its gas should be carried out in distinct apparatus from that used for the coal gas which is to be enriched. But when the products of the carbonization of coal and cannel are permitted to mix in the hydraulic main, there is no doubt that the diluents of the coal gas retain hydrocarbon vapours from the cannel, which would be thrown down were only the vapour saturated cannel gas present. Some of these vapours are retained obstinately by the mixed gas, and contribute considerably to its illuminating power. If the proposal made by Messrs. Young and Glover were carried into effect, such vapours would be lost to the mixed gas. The aim of these gentlemen might perhaps be less harmfully achieved if a separate hydraulic main were reserved for cannel gas, and coal gas from the outlet of the condensers were introduced into the cannel gas hydraulic main. The advantages of the dilution of the cannel gas while hot would be thus secured; while coal tar would not be brought in contact with the cannel gas.

Enrichment of coal gas by a few candles can be easily and surely effected by the addition of cannel gas, either in the hydraulic main or at a more forward point in the stream of coal gas. The plant employed for the production of cannel gas is identical with coal-gas plant; and therefore a specially trained staff of workmen for its manipulation is unnecessary. In this respect cannel has a distinct advantage over other enriching materials. Its most palpable disadvantage is that the precise degree of enrichment cannot be adjusted to a nicety, nor rapidly varied. Nevertheless the only serious objection to the continued use of cannel gas for enriching is its expense, when compared either with its former cost or with that of new rivals. The cost of cannel gas varies very much with the local conditions, and with the quality and price of the cannel, which are also very variable. It is therefore useless to quote many of the computations of the cost of enriching by cannel gas which have been published. Carbonizing charges are practically identical with those for coal gas; but in many cases the fuel account is perhaps slightly heavier. Residuals are less valuable from cannel than from coal. The quantity of tar is rather greater; but its quality is inferior. The production of sulphate of ammonia is about the same in the two cases. The yield of cyanide from cannel gas does not appear to have been closely observed; but it is doubtless nearly the same as from coal gas.

The coke from cannel is generally greatly inferior to that from coal; and its quantity is less. Some rich cannels yield only 35 to 45 per cent. of coke, of which as much as 70 per cent. is sometimes incombustible material. Many of the poorer cannels give a very inferior coke, which is loaded with ash and sulphur. That the proportions of these impurities are, however, very variable may be seen from the following figures, which are from analyses, hitherto unpublished, of cannels now on the market:—

Percentage of—	(1)	(2)	(3)	(4)	(5)
Ash in the coke	41·0	26·25	21·0	18·20	13·10
Sulphur „	2·9	3·42	1·1	0·75	1·22

In most cases, a ton of cannel yields coke having less than two-thirds the value of the coke from a ton of Durham coal. The total returns for residuals are generally less than four-fifths of those for an equal amount of coal. It is therefore possible to estimate approximately the holder cost of cannel gas, and the cost of enrichment by it, if the cost of the cannel on the works and the yield and quality of the gas from it are known. The carbonizing charges can be ascertained from the similar charges for coal gas at the same works. Cannel gas, like most enriching gases, appears to have a higher illuminating value as an enriching agent than when consumed alone; but precise figures in support of this observation are wanting. In most computations, the enriching value of cannel gas has been assumed to be proportional to its candle power. For enriching coal gas by a few candles only, this method of computing the value of cannel gas as an enriching gas is probably unjust to it. It has, however, been generally used; and the following examples have been worked by it. The figures given are Mr. Thomas Holgate's computation of the cost of cannel gas enrichment at Halifax, and Mr. A. F. Browne's similar computation for London.*

Cost of Enrichment by Cannel Gas.

	At Halifax. Pence.	In London Pence.
Cost per 1000 cubic feet of—		
15-candle common coal gas	9·000	12·0
35-candle cannel gas	—	32·0
28·54 „ „ „	16·750	—
17-candle mixed gas	10·145	14·0
Cost of 2 candles enrichment per 1000 cubic feet	1·145	2·0
Cost of enrichment per candle per 1000 cubic feet	0·572	1·0

The Halifax figures are obtained on the assumption that cannel yielding 11,466 cubic feet of 28·54-candle gas costs 15s. per ton on the works, and that coal yielding 11,900 cubic feet of 15-candle gas costs 8s. 6d. per ton. In Halifax, each candle above the 15 candles of the coal gas costs 0·572d. per 1000 cubic feet; and in London, it is estimated to cost about 1d. Similar figures will be given later on for enrichment by other enriching gases.

(To be continued.)

* See "JOURNAL," Vol. LXVII., p. 1162.

THE AGRICULTURAL VALUE OF SULPHATE OF AMMONIA.

In the "JOURNAL" for May 18, we gave some extracts from a paper on the above subject read by Mr. F. J. R. Carulla, F.C.S., before the Iron and Steel Institute. Owing to want of time, no discussion of the paper took place; but it has since been submitted to "correspondence" by members of the Institute and others; and extracts from the letters received by the author have since been issued as a reprint from the last published volume of "Transactions." We purpose to-day giving some of the comments thus elicited on Mr. Carulla's paper.

Mr. H. KELWAY BAMBER stated that, with regard to the relative values of ammonium sulphate and sodium nitrate, the latter had a more forcing effect on some crops if applied in spring, when active growth was taking place; but all that the plants could not rapidly absorb, and make use of, was speedily lost by being washed out of the soil by rain and carried away in the drains. Ammonium sulphate had a slower effect—probably from its having first to be converted into nitrates before being taken up by the plants. The surplus not thus used by plants was, however, not lost in a loamy soil, but was held by the loam, and gradually converted into nitrates and rendered available for the future use of plants. Ammonium sulphate had, therefore, a prolonged and more permanent effect on vegetation; whereas sodium nitrate must have an immediate effect or none at all. He had had some 15 years' personal experience in farming himself; and he had no doubt that ammonium salts had the most beneficial effect on land, whereas sodium nitrate forced most growth, to the detriment of the finer grasses and clovers, and to the injury of the malting property in barley. Sodium nitrate, for these reasons, could only be of use when the plants were in active growth, when they could rapidly make use of it; whereas ammonia salts could be applied to loamy soils at almost any time. Unfortunately, farmers, as a rule, knew nothing of the proper use of these manures, and were dependent on the advice of people from whom they purchased these manures. Therefore the substance which was most advertised and pushed, got the largest sale, very often to the farmer's loss. Ammonium sulphate and slag phosphate applied to the land at different times (not mixed before putting on the land) made an almost perfect manure; the deficiency being potash salts, which could be easily and cheaply applied in the form of kainit. The increased production of ammonium sulphate from blast-furnaces had, of course, brought down the price, as well as that of nitrates; but the relative value of ammonium sulphate was greater than that of sodium nitrate, besides its containing a much larger percentage of nitrogen.

Messrs. BRADBURY and HIRSCH (Liverpool), in reference to the relative progress in consumption of nitrate of soda and sulphate of ammonia, repeated what they said in their "Annual Review for 1896" of the sulphate of ammonia market—namely, that sulphate of ammonia producers were labouring under a serious misapprehension in thinking that nitrate of soda had been displacing their product, at any rate, in recent years. Where nitrate of soda had made progress on the Continent, it had been on new ground, where it had been advertised and pushed. On the older ground, and in the United Kingdom, it had barely held its own. It did not seem to be appreciated that within the past six years the world's consumption of nitrate of soda had only increased about 12 per cent.; while the increase in consumption of sulphate of ammonia in Europe within the same period had been probably 50 per cent. Where sulphate of ammonia had been displaced it had been displaced by other sulphate of ammonia. Such displacement as there had been in Germany, for instance, had been by sulphate of ammonia produced in Germany and Belgium; and the wonder was rather that English sulphate of ammonia had so well held its ground. The United Kingdom production within the past ten years had increased something like 80 per cent.

Mr. E. A. BROTHERTON (Birmingham and Leeds) cordially agreed with the author as to the advisability—indeed, imperative necessity—of the publication and distribution broadcast among agriculturists, of literature written in the interest of sulphate of ammonia. In preference to essays on the virtues of the product, he would suggest that articles of a lighter character, the great features of which should be pictorial contrasts, would prove more attractive to those whom it was intended to reach, and would in consequence be more effective in making known the character of sulphate of ammonia as a fertilizer.

Professor F. CLOWES, D.Sc. (of University College, Nottingham), considered that the author had drawn attention to a very important matter. His conclusions seemed reasonable and well-founded, and were of great interest not only to the ironmaster and gas maker, but also to the farmer. It was surely important that a home-product, like sulphate of ammonia, should not be neglected in favour of imported nitrate of soda, especially when the sulphate of ammonia was shown to be, weight for weight, of greater manurial value than the nitrate, and that its ammonic nitrogen was as effective as the nitric nitrogen of the nitrate. In view of the attempt, already largely successful, to utilize as manure the nitrogen derived from the coal of the blast-furnace in the form of sulphate of ammonia, ironmasters would, he thought, do well to take to heart the author's words, and to make his facts and conclusions widely known. The maker of steel was already contributing to agriculture the valuable phosphatic manure known as basic slag. The value of this was now incontestable. It was interesting to know that another class of manuring agent, containing a wholly different ingredient, was now likely to be furnished in quantity by the iron-smelter who used raw coal wholly or partially in his furnaces. At the present day experiments, such as those made by Paul Wagner, were carried out on many experimental agricultural plots; and the results were made known by County Councils for the good of the farmer. No one was likely to contest Wagner's results; but a repetition and confirmation of them in our agricultural stations in this country would doubtless rouse interest, and draw attention to the comparative indifference which was shown towards home-made sulphate of ammonia.

Mr. ROBERT DEMPSTER (Manchester) wished the author's paper had gone farther in the same direction, as a good deal more similar evidence could be adduced. The sulphate trade had been too indifferent; while nitrate sellers had never ceased to put forth everything possible in their own favour, to show that nitrate was superior to sulphate of ammonia. If sulphate makers exercised the same energy as their competitors, and took all available opportunities to show the advantages it possessed on the growth of all crops requiring nitrogenous food, nitrate would not have outstripped sulphate as it had done. Farmers, either in this country or on the Continent, only required to be informed, by acceptable, simple, and readable literature, of the incontrovertible superiority of sulphate—a given weight containing, as it did, 25 per cent. more nitrogen than the same weight of nitrate of soda—together with the practical and successful result of authoritative trials, to induce them to adopt it permanently as the cheapest and most effective nitrogenous manure.

Mr. JOHN GOLDING (Lecturer on Agricultural Chemistry in the University College, Nottingham) sympathized with the author's plea on behalf of sulphate of ammonia, and agreed with him that, as compared with other nitrogenous manures on the market, its price at the present time was below its real value. At the same time, he did not agree with him in supposing that any new name—such as "nitrogenous sulphate"—would be likely to remedy this discrepancy, as farmers had too often been imposed upon by vendors of so-called manures, with high-sounding names, but of little or no value in themselves. The varying results obtained in practical experiments on the comparative value of sulphate of ammonia and nitrate of soda were very frequently due to the character of the season, as might be well seen by reference to the experiments conducted by Sir John Lawes and Sir Henry Gilbert. Their results showed that in certain years the ammoniacal, and in other years the nitric nitrogen produced the greater crops. It was an old saying with practical farmers, that nitrate of soda was suitable for dry weather and sulphate of ammonia for wet; the reason being that the soil possessed the power of holding or fixing salts of ammonia, while it exercised no such power on nitrate of soda, which latter would consequently be washed away in a wet season. On the other hand, there was little doubt that nitrates were more easily assimilated by plants than ammoniacal nitrogen. It was also highly probable that sulphate of ammonia was to a very large extent changed into nitrates by certain bacteria existing in the soil before it was assimilated by plants. Experiments by other scientists had also shown that the period of growth of the plant had not a little to do with the kind of food it required; while with different kinds of plants the one or the other manure might have a preponderance. Those interested in the sale of sulphate of ammonia would do well to emphasize the fact that it could with safety be mixed with superphosphates and other acid manures, while nitrate of soda would suffer loss of nitrogen by such treatment. He further advocated experiments in the comparative value of these two forms of nitrogen, having special regard to the presence or absence of the micro-organisms existing in the soil. He failed to see the reason why, unit for unit, sulphate of ammonia should be much cheaper than nitrate of soda, in view of the fact that the former was so easily oxidized to nitrates in the soil by the action of micro-organisms. These points, combined with the fact that the manufacture of sulphate of ammonia was a home industry, should, when known, tend to bring it more into favour with the British farmer; and he therefore supported the author in his advocacy of the publication and free circulation of the advantages to be obtained from the use of this home product.

Mr. T. VAUGHAN HUGHES, Assoc.R.S.M., F.I.C., said that, granted the object of the paper might be speedily attained, it was to be hoped that makers of ammonium sulphate would exercise the greatest care, and prevent the placing on the market of a fertilizer containing ingredients highly deleterious to plant life—such as sulphocyanide of ammonium. Further, it would be well if the sellers bartered their salt on the basis of its nitrogen content, and insisted that its worth should be computed on the "units of contained nitrogen." Any harmful substances incorporated with it, or adulterants likely to render it useless as a fertilizer, should cause its rejection. Sufficient stress could not be laid upon these points. Sales effected under the provisions of the Fertilizer and Feeding Stuffs Act would ensure confidence in buyers. Let it be remembered that one season's bad result, following the application of a parcel of ammonium sulphate containing substances harmful to plant life

on a farm, would ruin the prospects of the more extended use of this artificial manure by the British agriculturist for years to come.

Mr. EDWARD JACKSON (H.M. Inspector under the Alkali Acts) thought that probably one of the main difficulties was with the farmers, who were most conservative in all matters, and might have some prejudice as to any products from so-called "chemical works." Nitrate in their eyes did not labour under this disadvantage. Possibly a change of name might result in an improved demand for ammonium sulphate for agricultural purposes.

Mr. J. F. KEMPSON (Pye Bridge), while agreeing generally with the author, thought that, to meet the problem before them, it was necessary to go further than popularizing the use of sulphate of ammonia for agricultural purposes, at least as such were carried on in Great Britain. The recovery of nitrogen from coal, shale, &c., was not only enormous, but was capable of great expansion on any rise in values. This pointed to the wisdom of those who were interested in nitrogen recovery looking to new developments in its application. In approaching this part of the subject, they should regard conditions which, though anomalous, might be frequently found side by side. He alluded to such matters as cheap materials, unemployed labour, undeveloped land, cheap water carriage, deposits which must be removed even at a dead expense, &c. For present purposes, these conditions could all be more or less found in the districts of the Clyde, Tyne, Tees, Mersey, and South Wales. There was an immense area of rocky land easily accessible by water-carriage, the soil on which was only a few inches deep, that was commonly regarded as useless for cultivation. This was too easily taken as inevitable with such fertilizers, as sulphate of ammonia and basic phosphatic slag were produced cheaply in close proximity. By the free use of artificial manures and judicious culture, a productive soil might be created. To deepen the soil on rock, sewage sludge could be used, and might be mixed with sandy dredgings, which had to be raised, but were simply taken out to sea. In the case of sewage sludge from lime precipitation, it would be necessary to modify the treatment as to the application of sulphate of ammonia. Another direction in which sulphate of ammonia and basic slag might find application was in the English production of beet sugar. This had been proved to be possible on a manufacturing scale; but the enterprise was discontinued owing to the uncertain supply of beets. He thought it spoke badly for English intelligence and interprise that sulphate of ammonia had to go abroad; and that, when the value of basic slag was first demonstrated, the rush to get this cheapest source of phosphorus for agriculture was from foreigners.

Mr. FRANK LIVESEY considered the points raised by the author were of great importance, not only to the members of the Iron and Steel Institute, but also to gas managers generally. The chief question raised was, Why should the nitrogen in sulphate of ammonia be of less value than in nitrate of soda? With this point the author had dealt fully, though perhaps he might have added that sulphate was a far superior salt for mixing with other fertilizers than nitrate. Indeed, it was a question whether it could be mixed at all except by the farmer on the ground; the deliquescent properties of nitrate being the trouble. Was not the low price of sulphate due in a very large measure to the way in which it was commercially handled? Under the existing state of things, the producer was inaccessible to the consumer, owing perhaps to some condition of sale. The dealer who intervened was consequently very powerful; and, being a speculator, he naturally forced variations in price to his own interest. This militated against sulphate of ammonia, as the consumer was never sure of the price he might have to pay. The managers of gas undertakings, and possibly of iron and steel works also, were not in a position to watch the market, and could not expect, therefore, to be successful speculators. Inasmuch also, as sulphate was not produced in accordance with the demand, but in accordance with the demands for other products, it was not a wise policy to stock this material to any great extent. The author stated that all the fertilizing qualities the farmer required could be obtained from basic slag and sulphate of ammonia. Would it not be wiser to recommend sulphate, because it could be mixed, and so more nearly approach the complex nature of a perfect manure? This, as already explained, could not be done with nitrate. The Sulphate of Ammonia Committee that had been formed might do some useful work by bringing before farmers the value of sulphate as a fertilizer, and by explaining where and when it was superior to nitrate. It to some extent was a matter of climate or atmospheric conditions. Sulphate of ammonia was, he thought, so well known that it seemed quite unnecessary to change its name. It would in his opinion do more harm than good.

Colonel S. A. SADLER (Mayor of Middlesbrough) considered that the subject brought forward by the author was one of deep interest to ironmasters and to chemical manufacturers; for latterly ironmasters had to look to the residual products for their profit. In Scotland, the bye-products were obtained from the blast-furnace. In Westphalia, and to a considerable extent in the North of England, they were obtained from the coke-ovens. Recently Dr. Ludwig Mond had gone a step further by devising a method of recovery of ammonium sulphate from producer-gas. The advent of large quantities of ammonium sulphate from those sources had been so sudden and unexpected, that it probably had much to do with the collapse that had taken place in its value. More and more sulphate would, he thought, be put on the market by iron and coke makers, no matter to what the price might be reduced, so long as it would pay to recover it—say, £5 per ton. Undoubtedly the chief cause of the abnormal position of sulphate in relation to nitrate of soda was the large inducements that the Nitrate Committee were able to offer, to advertise nitrate. Nothing of the sort had hitherto been done by sulphate producers. The physical superiority of sulphate over nitrate for agriculture should not be overlooked. Sulphate was a friable efflorescent salt easily mixed and handled; while nitrate was deliquescent, and always exhibited a tendency to cake. Moreover, the much greater solubility of nitrate as compared with sulphate was a serious drawback to its application in wet climates.

Mr. JAMES O'SULLIVAN (Burton-on-Trent) felt certain that the unit of nitrogen in the nitrate was of no more value than it was in sulphate of ammonia. Advertisements of nitrate which were continually put in the hands of the farmer had, he considered, more to do with its sale than its composition.

Mr. CHARLES TAYLOR (Derby) said it appeared to him perfectly clear that the "booming" of nitrate of soda had placed it in a position to which it was not intrinsically entitled, and that sulphate of ammonia was generally the cheaper article at from £2 to £3 per ton more money. The remedy for the evil and misconception in regard to the use of sulphate of ammonia was, he thought, to be found in advertising and in collecting the already well-written literature on the subject, and adding thereto tabulated expert information upon the application of sulphate of ammonia under the various conditions affecting particular localities, so that the farmer would not be called upon to treat his soils with indefinite knowledge as to their requirements. Much might be said in favour of changing the name to that of "nitrogenous sulphate;" and the change was fully justified by the fact of its containing, weight for weight, about 25 per cent. more nitrogen than is contained in nitrate of soda.

Mr. CARULLA wrote in reply: It is quite true, as Mr. Dempster points out, that more evidence similar to that given in the paper might be adduced. The point so prominently brought out by Messrs. Bradbury and Hirsch is apt to be overlooked. The sulphate of ammonia producers are not only harassed by the nitrate of soda interest, but they are in a state of civil war among themselves. In such circumstances, it is quite possible to overrate the harm done by nitrate of soda; but none the less the need for concerted action remains. Colonel Sadler also fully proves this; and it must be repeated that nothing except special literature and plentiful advertising seems likely to be able to bring back prosperity to this home industry. The institution of local experiments, as recommended by Dr. Clowes and others, is also a matter that deserves attention, as farmers are more likely to be impressed by results obtained in their immediate neighbourhood than by reports of performances in other countries, where both climate and soil may be different from their own. Frank Livesey rightly says that nitrogenous and phosphatic manures are not the only requisites for the growth of crops. Lime is largely present in basic slag, but potash, which is also essential, can only be economically obtained from such sources as kainit. The paper was not intended to convey so erroneous an impression as that nitrogenous and phosphatic manures are the only essentials. Mr. Livesey objects to the suggested change of name, as does Mr. Golding; and it may be that a middle course would be the best. The scientific term ammonium sulphate, used by some of the writers, also places the idea of sulphate secondary, and it might be well to adopt it for common use—the impression of "chemical works," mentioned by Mr. Jackson, not being conveyed so forcibly as by the present name. Possibly Mr. Kempson's suggestion might be of value in particular localities, but where good land is already going out of cultivation, there could be no advantage in attempting to reclaim the wastes. The statement of the money paid away by this country for sugar that might be produced by ourselves, goes some way to confirm the calculation that England only consumes one-sixty-sixth of the nitrogenous manures that could be used with advantage. There is therefore plenty of inducement and justification for the various sections of ammonium sulphate makers to work amicably together, with the single aim in view of spreading the knowledge of the intrinsic value of their product among home-farmers.

Professor Dixon on Explosions of Gases.—At the Toronto meeting of the British Association, Professor Harold B. Dixon, in continuation of his previous work on explosions of gases, dealt with the curious phenomena attending the commencement of an explosion in a gaseous medium, which may be investigated by photographing the flash. If, he said, the mixture be fired at the end of a tube, the disturbance very gradually increases in velocity as it passes along the tube, until after a comparatively great distance has been traversed, the velocity characteristic of the mixture is reached. When, however, the firing-point is from 3 to 4 inches from the end of the tube, the disturbance passing slowly down the longer portion of the tube is reinforced by the wave which has traversed the short distance to the end of the tube, and has there been reflected. After this reinforcement, the united disturbances travel at a much more rapid rate; and he maximum velocity is quickly attained.

REGISTER OF PATENTS.

Manufacture of Illuminating Gas.—Young, W., of Peebles, Glover, S., of St. Helens, and Glover, T., of West Bromwich. No. 20,125; Sept. 11, 1896.

This is the invention that formed the basis of the paper read by the last-named patentee at the Bath meeting of The Gas Institute in June (see *ante*, p. 16). The inventors say they make no general claim to the washing of illuminating gas with liquid hydrocarbons for the purpose of absorbing the condensable hydrocarbons, nor yet do they claim the carburetting of coal gas by means of volatile hydrocarbons. Both, they point out, have been extensively applied—the first for the recovery of the condensable hydrocarbons present in waste gases from the distillation of shale for the production of oil, and also for the recovery of the benzol and other condensable products from the gases purposely produced from coal; and poor coal gases have been extensively carburetted with very volatile liquid hydrocarbons having much higher vapour tensions than that of naphthalene. What they consider to be novel and original, and therefore claim, is: 1. The manufacture of illuminating gas by carbonizing coal at high temperature, and washing or similarly treating the resulting gas with such liquid hydrocarbons as are adapted to absorb or remove the crystallizable naphthalene present in the gas. 2. The method of carburetting and improving the illuminating power of gas resulting from carbonization of coal at high temperature, by commingling therewith, after such gas has been cooled and freed from the major part of the tar and naphthalene, gas produced by carbonizing coal, cannel, or other hydrocarbonaceous material at such low temperature as will ensure the production of gas of high quality, and of liquid hydrocarbons comparatively free from naphthalene, and adapted to absorb or remove the naphthalene remaining in the high-temperature gas. 3. The method of carburetting gas resulting from carbonization of coal at high temperature, by volatilizing into such gas the vapours of liquid hydrocarbons having a solvent action on naphthalene, and having a similar vapour tension, in order to absorb or remove the naphthalene in solution and prevent its deposit in solid form.

The patentees do not illustrate their specification; but it is of so interesting a character—in fact, like a supplementary paper—that it is proposed to give it almost *in extenso*. The invention comprises methods or processes having for their object the remedying of certain difficulties which have been experienced when coals are carbonized at very high temperatures, with the view of producing a large volume of gas from a given weight of coal. When coals are so carbonized, there is produced a large volume of gas, but a comparatively small quantity of condensable hydrocarbons in the form of tar; the large volume of gas being mostly derived from the decomposition of the hydrocarbon products which would be left as tar on carbonizing the coals at lower temperatures. The decomposition of the volatile and gaseous products from the coal, when carbonized at very high temperatures, has also the effect of considerably altering their constitution; for while lessening the yield of liquid products, the percentage of naphthalene is so largely increased that there is difficulty experienced in getting the liquid condensable products to take it up in solution during the condensing process. The consequence is that the gas is liable to carry forward in diffusion a part of the naphthalene, which is subsequently deposited during the distribution of the gas in the mains and services—more or less closing them up, and giving much trouble in various ways. The gases produced from the coal carbonized at very high temperatures, although large in volume, has a low illuminating power.

The object arrived at is to overcome these difficulties; and the invention consists in providing and applying a supplementary supply of hydrocarbon fluids, to wash or otherwise act upon the gases produced at high temperatures, so as either to absorb and remove the naphthalene ordinarily left in the cooled gas, or to carburet the gas in such a manner as will increase the illuminating power and prevent the naphthalene being deposited in the crystalline or solid form. This supplementary supply of hydrocarbon liquids for the treatment of the high-temperature gas may be derived from various sources (dependent upon the convenience and economy in the supply, and the treatment to which it is desired to submit the high-temperature coal gases); and it may also be applied in various stages, during the process of manufacture, dependent upon the constitution of the hydrocarbon supply.

When the sole object is the removal of the naphthalene from the gases produced at high temperatures, any liquid hydrocarbon that has a large solvent power for naphthalene vapour may be employed—such as the distillates of ordinary coal or oil gas tars, or the distillate of the tars recovered from blast-furnace gases, or other cheap hydrocarbon liquids. When such distillates contain naphthalene in solution, they are cooled to a low temperature, which causes the naphthalene to separate in the crystalline form, when it is removed by filtration through filtering presses. The hydrocarbon liquids so prepared are applied to the treatment of the high-temperature gases by bringing them into intimate contact with such gases (in a manner similar to that by which water is employed to dissolve the ammonia out of the gas), in any convenient form of washer or scrubber, after the high-temperature gases have been cooled and freed as far as possible from the high-temperature tars and naphthalene.

When first brought into contact with these high-temperature gases, the solvent hydrocarbon liquids act somewhat differently—dependent upon their constitution. If of a high boiling-point, they will at first not only dissolve out of the gas the naphthalene, but also a part of the other hydrocarbon illuminants. On the other hand, if the hydrocarbon liquids having a low boiling-point be present in the solvent hydrocarbon fluid, they will—owing to their high vapour tension—be partially volatilized and diffused through the gas; while the naphthalene—owing to its comparatively low vapour tension—will be absorbed. But whatever may be the original constitution of the washing hydrocarbon liquids, they after a short time either become saturated with the illuminants present in the gas, or give up to the coal gas such a portion of the vapours of the volatile hydrocarbons that may be present in them as to bring about a balance of the affinities in these respects. Thereafter the solvent power of the washing liquid is confined to dissolving the naphthalene out of the gas. Or, instead of allowing the hydrocarbon liquids with high boiling-points (so employed to wash the gas) to become saturated by dissolving the illuminants present in the gas, their solvent power may be restricted to dissolving out the naphthalene by keeping them—by means of a steam-coil or other equivalent—at a temperature sufficiently high to prevent them absorbing the illuminants having a high vapour tension, while yet low enough to allow them to absorb the naphthalene with the comparatively low vapour tension. Or, again, the absorbent liquid hydrocarbon may have added to it, prior to its being brought into contact with the gas, such a quantity of volatile hydrocarbons as will limit the action of the absorbing fluid to the dissolving out of the naphthalene.

On the washing hydrocarbon liquid becoming so charged with naphthalene that it ceases to be effective in washing the gas, it is drawn off from the scrubber and refrigerated. This causes the naphthalene held in solution to crystallize out; and it is then separated by filtration. The washing hydrocarbon liquid is returned to the scrubber for re-use.

Should the high-temperature gases not have been perfectly cooled or freed from tarry matters, prior to being brought into contact with the washing hydrocarbon fluids, they become so contaminated with tarry matters that the naphthalene absorbed from the gas by the washing liquid cannot be separated by simply cooling and filtration; they require to be subjected to a preliminary distillation, so as to fit them to undergo the filtering process.

In the case of gas-works where plant exists for the distillation of the ordinary coal tars, this mode of applying the invention can be very conveniently carried into effect by collecting the early part of the distillate of the tar, separating the naphthalene which may be present in solution by refrigeration and filtration, and using the distillate so prepared in any convenient scrubbing or washing arrangement to wash the cooled high-temperature gases and free them from naphthalene; while at the same time the benzol and the other hydrocarbons are volatized into the gas—adding to the illuminating power. On the coal-tar distillate ceasing to be effective in scrubbing the gas, it is either run direct to the tar-well, or sent back to the tar-stills to undergo distillation and filtration, and may thus be prepared for re-use.

When the object is to carburet or increase the illuminating power of the gas produced from coal at high temperatures, while at the same time removing the naphthalene, or otherwise preventing its precipitation in the solid form, the necessary hydrocarbon liquids are specially produced or prepared for the purpose by subjecting some hydrocarbonaceous substance to carbonization or cracking-up at such a low temperature, in any convenient retorting arrangement, as will ensure the production of a considerable volume of high-quality gas, and as large a production as possible of liquid hydrocarbon products so free from naphthalene as to be suitable to absorb the naphthalene from the coal gas produced at high temperatures, and containing volatile hydrocarbons suitable for being diffused through the high-temperature gas, and thus add to its illuminating power and prevent any naphthalene that may escape absorption and accompany the gas from being subsequently deposited in the solid form.

The hydrocarbonaceous substance suitable for the production of the hydrocarbon fluids for washing out the naphthalene and carburetting the coal gas produced at high temperatures by carbonizing or cracking-up at low temperatures, are coals, shales, or other similar solid bituminous substances, or liquid hydrocarbons that have been produced at low temperatures—such as blast furnace petroleum or paraffin oils.

The products resulting from the carbonizing or cracking-up of those substances at low temperatures, are brought into intimate contact (either while still hot and in the form of vapour suspended in the accompanying gas, or after having been cooled) with the coal gases that have been produced at high temperatures, after such gases have been cooled and freed as far as possible of the accompanying tars and naphthalene. The volatile products from the carbonizing or cracking-up of the hydrocarbonaceous substances at low-temperatures, are thus diffused through the high-temperature coal gas; while the low-temperature condensed products are at the same time enabled to absorb the naphthalene. Should part of the naphthalene escape absorption and pass away with the gas, it is either held in diffusion or otherwise prevented from being deposited in the solid form, by being absorbed and dissolved by the accompanying condensable liquid products.

The condensed liquid products that have been thus once used to treat the coal gas, if found to contain considerable quantities of low-temperature products (paraffins and olefines), are again subjected to further cracking-up at low, but yet increased temperatures, so as to produce a further supply of liquid hydrocarbons free enough from naphthalene to enable them to be re-used to absorb that substance from, and to carburet the high-temperature coal gases in the manner described. The process is repeated till the quantities of naphthalene accumulating in the condensed products (due to the absorption of the naphthalene from the high-temperature gas, or its production during the recarbonizing of the liquid products at the higher temperatures) interfere with their action as washing agents. They are then cooled; and the crystallized naphthalene is filtered out in the manner described.

A convenient method of carrying out this modification of the invention in existing works, and involving little alteration or additions of plant, consists in dividing the retorts into two sections—a large section for carbonizing the coal at very high temperatures for the production of a large volume of gas, and a smaller section of the retorts for the distillation of a part of the same or a higher quality of coal or shale at a lower temperature, so as to produce gas of a high illuminating power and a supply of condensable hydrocarbon products suitable for carburetting the high-temperature gases and for absorbing the naphthalene therefrom. The gases and products from the coal carbonized at the high temperatures are passed through the ordinary condensing plant in the usual manner.

The gases and products coming from the coal or shale carbonized at the low temperature, are conveyed by a separate pipe (preferably kept warm either by lagging with some non-conducting material, or by means of a steam-jacket or internal steam-pipe) and commingled with the condensed high-temperature coal gases after these gases have been condensed and freed as far as possible from tarry matters and naphthalene, at or near the terminal of the ordinary condensers.

In the case of works where the ordinary condensers are of sufficient capacity, and provided with arrangements for drawing off the condensed products as precipitated, the low-temperature gases and products are admitted into the terminal end of the condensing arrangement among the high-temperature gases; and the latter part of the condenser is employed to cool the combined gases. But where this is not the case, a supple-

mentary condenser (or preferably a combined condenser and washer) must be provided for bringing the two gases and low-temperature products into intimate contact.

The condenser hydrocarbon products left in the condenser or scrubber in which the high-temperature coal gases are treated with the lower-temperature products, are somewhat differently dealt with—dependent upon their constitution, which in turn is dependent on the character of the coal or shale from which they have been produced and the temperature at which they have been carbonized.

When ordinary bituminous coal or the lower qualities of cannel or shale are the materials employed to produce the lower-temperature products, the most convenient method is to carbonize them at such a low temperature as will produce condensable products which, while containing a low percentage of naphthalene (and thereby enabling them to act as an efficient absorbent of naphthalene), will yet be sufficiently high to crack-up the major part of the paraffins and produce a large percentage of the olefine and benzol group of hydrocarbons suitable to carburet the gas. In such a case, the condensed lower temperature products are allowed to flow directly to the tar-well, as they can without injury be commingled with the ordinary coal tars.

On the other hand, when the higher qualities of cannel or shales are employed to produce the lower temperature products, the temperature employed to carbonize in the low-temperature retorts may with advantage be lower, as higher results are obtained by subsequently re-carbonizing the condensed low-temperature liquid products. Besides the tars from such high qualities of cannel and shales are, even when distilled at high temperatures, so rich in paraffins as to seriously deteriorate the quality of the coal tars when mixed with them. Under such conditions, the condensed low-temperature products left from the treating of the high-temperature coal gases, are drawn off from the terminal of the condenser or washer; separated; and subjected to re-carbonization by any of the well-known methods of decomposing liquid hydrocarbons—the resulting products being re-used in washing the high-temperature coal gases.

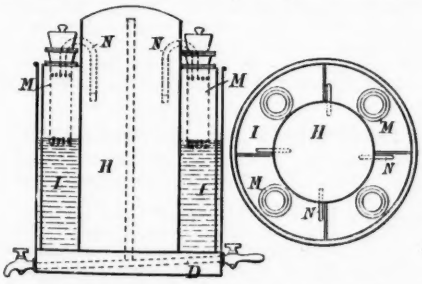
The proper temperature to employ in the lower-temperature carbonizing process necessary to produce the desired results, depends upon the original molecular structure of each coal, cannel, or shale, and can only be ascertained by trial with each individual class of material; the tars being subjected to distillation, and tested for the presence of paraffins and naphthalene by the usual methods, and the temperatures of carbonization regulated accordingly.

Another method of applying the invention, to prevent the precipitation of naphthalene in the solid form from coal gases produced at high temperatures, is to volatilize into such naphthalene-charged gas the vapours of any convenient hydrocarbon having a solvent affinity for naphthalene, and also having a similar or approximate vapour tension, in such quantities that, in the event of the naphthalene-charged gas being subsequently subjected to such a low temperature as to cause the naphthalene to precipitate from the gas, there will be simultaneously condensed such a proportion of liquid hydrocarbons as will dissolve it and hold it in solution.

The liquid hydrocarbons suitable for this purpose are the portions of the distillates of coal tars, blast-furnace tars, paraffin, and some varieties of petroleum oils whose solvent power for naphthalene is considerable, and whose vapour tension approaches that of naphthalene. They are volatilized into the naphthalene-charged gas in any convenient carburetting arrangement in which the temperature and the quantity admitted can be so regulated as to cause the volatilization of the requisite quantity of volatile hydrocarbons to produce the desired result. As the quantity of volatile hydrocarbons required varies (dependent upon their constitution) as the quantity of naphthalene in the gas, the necessary quantity under each circumstance must be ascertained by testing the gas leaving the carburetter, by passing through a tube cooled to such a temperature as to cause the precipitation of condensable products. If not sufficiently charged with the hydrocarbon liquid, the naphthalene is deposited in a more or less solid form; if, on the other hand, more hydrocarbon liquid has been added than necessary, the condensed matters will not only be liquid but will have absorbed a considerable portion of the illuminating vapour from the gas. The quantity has to be regulated in order to avoid either condition.

Acetylene Generators and Holders.—Maddock, E. H., and Jones, W., of Liverpool. No. 22,359; Oct. 8, 1896.

This apparatus consists (as usual) of a cylindrical or other vessel, having another inverted vessel rising within it. The outer vessel is preferably double bottomed, or there is a space below the bottom surface sufficiently large for a pipe D to traverse it from side to side. The pipe is formed sloping, and has a cock at each end (the ordinary service-cock



as an outlet for the gas, and a drip-cock to be opened when required to draw off any condensed moisture). A branch from the pipe D rises up the centre of the vessel to near the top of the gasholder or interior vessel, which consists of a central cylinder H, with an annular exterior chamber I. The central cylinder can be open or closed at the bottom as desired. The outer chamber is divided by numerous partitions (four in the drawing) into compartments, and is open at the bottom. In each of these compartments is a carbide holder of any ordinary description M. The form preferred is a cylinder perforated in its lower part, rising through a gas-tight joint at the top, and arranged with a slightly conical upper part to fit into the gas-tight joint. The holder has a perforated bottom, either fixed or loose; and there are perforations also near the top. Each holder is filled with carbide, and the external chamber is partially filled with water, which rises up in each compartment until it covers the lower part of the holders. From each compartment a pipe N, having a cock or a valve which only opens with a pressure towards the gasholder, connects the compartment of the annular chamber with the holder. Consequently gas can freely escape out of the compartment into the central compartment, but cannot pass back again; or, if there be a cock, it can pass into the central chamber only when the cock is open.

Production of Acetylene Gas.—FitzGibbon, L. T., of Piccadilly, W. No. 22,526; Oct. 10, 1896.

This apparatus, for the production of acetylene gas "on a commercial scale," it is claimed, effects the chemical purification of the gas produced in the generators, the gas is dried as it leaves the holder, and the calcium carbide being used in the form of agglomerate it is possible to regulate the re-action on it of the water by using a constant weight for a given volume of gas to be generated.

Fig. 1.

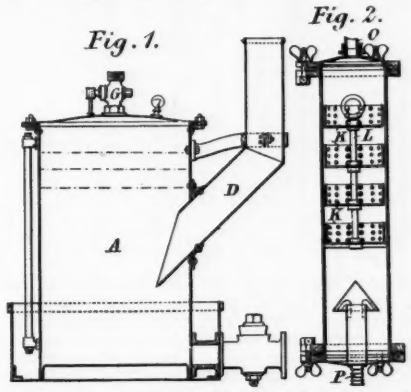


Fig. 2.

When in operation, the apparatus shown in fig. 1 acts as follows: The vessel A is filled with water up to the level indicated by the middle dotted line; the cock G is opened; and the quantity of carbide necessary for the production of the volume of gas it is desired to generate, is introduced through the feed-tube D. The carbide falls into the water, and gas produced accumulates until it escapes through the cock G into the holder. The pressure of the generated gas forces the water contained in A into the feed-tube D, up to the level above that of the water in the vessel; and this difference of level is sufficient to prevent the escape of the gas through the feed-tube.

Fig. 2 is a vertical section of the drying apparatus for the gas. K are perforated baskets; and L is a rod to which they are fixed, so that they can be moved together in the tube M. O is the outlet for the dried gas fitted to the upper cover. P is the attachment or nozzle through which the gas flows into the apparatus, over which a cone is fitted to prevent the entrance of carbide or lime into the tube.

It is well known, says the patentee, that the difficulty of practically utilizing the chemical reaction of carbide of calcium on water consists in the too great rapidity with which this reaction takes place. In apparatus hitherto in use, and acting either by the immersion of the carbide in the water or by the pouring of the water over the carbide, this difficulty has not been overcome. Accordingly he proposes to pulverize and mix the carbide with a suitable form of agglutinant, preferably paraffin, heated and liquefied in the proportion of from about 8 to 10 per cent., in such a manner as to form blocks or sticks which are compressed as in the manufacture of compressed fuel or of carbons for electric arc lamps. The carbide of calcium being thus distributed throughout a homogeneous mass, and mixed with one or more inert bodies, its action on water will, it is claimed, be regular, and not precipitate.

Gas or Oil Engine.—Tangye, J. H., of Soho, and Johnson, W., of West Bromwich. No. 23,110; Oct. 17, 1896.

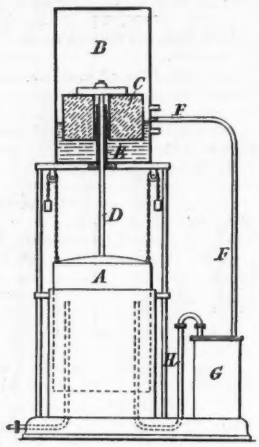
This engine is constructed as follows: In place of the cylinder and piston used in the ordinary gas-engine, a chamber is employed consisting of two parallel or nearly parallel plates—one rigid, the other made preferably of thin sheet steel. The plates (preferably circular, and the elasticity of the steel plate increased by forming a series of concentric corrugations in it) are connected together at their edges, either directly or by means of thin folded edges which will expand or collapse as the corrugated elastic steel plate recedes from or approaches the rigid plate. These joined plates constitute the detonating chamber of the engine; the elastic corrugated plate, when the detonation of an explosive mixture in the chamber takes place, having the function of the piston of the ordinary gas-engine. A piston-rod is connected by one of its ends to the centre of the elastic plate; while the other end of the rod is jointed to a connecting-rod, by which, on the to-and-fro motion of the elastic plate, rotation is given to a crank on the shaft of the engine. Passages for the introduction of inflammable gas or vapour and atmospheric air into the space between the two plates are provided, together with an exhaust-passage for the escape of the products of combustion and the residual nitrogen; but the opening and closing of these passages, as well as the working of the appliances whereby the ignition of the gases is effected, does not differ from similar operations in ordinary engines.

Manufacture of Acetylene.—Bécherel, C. F. J. B., of Paris. No. 23,289; Oct. 20, 1896. Date claimed under International Convention, June 27, 1896.

In one arrangement according to this invention (on next page), there is placed above an ordinary gasholder A a water-reservoir B, in which is a float C moving in direct connection with the bell of the holder, by means of a rod D (or a chain), in such a manner that it ascends and descends

with the movement of the latter. A central tube E is provided in, and extends for a suitable distance above the water-level in, the reservoir B, to allow of the passage of the rod or chain to the float.

When the volume of gas diminishes in the holder, the bell A will descend and carry down with it the float C, which immediately displaces, and causes the water-level to rise to the orifice of a pipe F, arranged at a suitable level. Through this pipe a certain amount of water flows into the generator G until the acetylene gas enters the holder through an inlet-pipe H and causes the bell to rise, thereby raising the float and



causing the level of the water to fall below the orifice of the generator supply-pipe. Instead of a single pipe from the reservoir to the generator, a series of such pipes at different levels may be connected with a series of generators, in such a manner that first one generator and then another would become exhausted, and so on. The rise of the water-level to the orifice of the pipe connected with the exhausted generator would only result in the filling of the pipe and its corresponding generator with water, without generating any gas. Consequently the pressure in the holder would continue to fall, and the float descend lower in the reservoir, until it had caused the water to rise to the orifice of the next higher outlet-pipe, when the generator connected to it would be put into operation, and a fresh quantity of gas generated.

Manufacture of Acetylene.—Bécherel, C. F. J. B., of Paris. No. 23,290; Oct. 20, 1896.

This invention relates to improvements in the apparatus described in patent No. 23,289 of 1896 (see above), consisting: (1) Of a generator or gazogene containing the carbide of calcium, or of a number of such generators arranged so as to be automatically brought into operation and exhausted in succession. (2) Of a receiver or vessel designed to contain the water required for decomposition, which is displaced as required by a float or floats. (3) Of an extensible gas reservoir or holder, with bell and water-seal, or this may be in the form of a bellows, or of a collapsible vessel of caoutchouc or other such material.

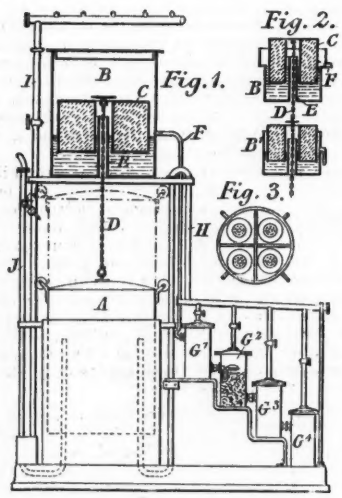


Fig. 1 is a side elevation (partly in section) of one form of apparatus. Fig. 2 is a vertical section through a modified form of the water-supplying device. Fig. 3 is a plan of another modification.

In fig. 1 four generators G^1 G^2 G^3 G^4 are arranged at different heights, or in steps or stages. A is the bell or other collapsible part of the holder; and when it descends, owing to reduction of pressure, it draws down the float C in the reservoir B by means of the connecting-rod or chain D, and so causes the water to rise and flow through the supply-pipe F to the generators, and to exhaust first the upper generator G^1, and then, as soon as it has reached in the latter a predetermined level, any further supply from the reservoir passes through a syphon into the second generator G^2, which it exhausts in turn; and so on, until all the generators are exhausted.

The acetylene as evolved passes by suitably arranged pipes to a larger pipe or collector H, which conveys it to the gasholder. From the latter, the gas passes by a discharge-pipe I to where it is to be consumed—for example, to a row of gas-burners T. The pipes from the generators to the collecting-pipe H are provided with suitable cocks; and the syphon-tubes connecting the generators are provided with union joints, so that any one of the generators may be readily removed for recharging while the apparatus is in work.

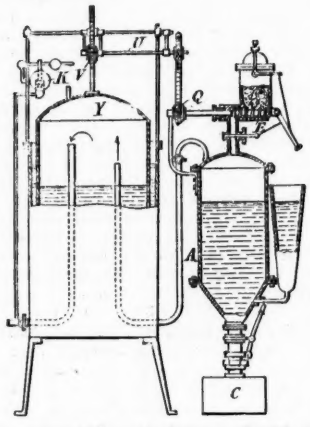
To prevent the level of the water falling below a predetermined point in the reservoir B, it is provided with a small auxiliary float adapted to automatically open and at the required times close the cock of the supply-pipe. With this arrangement, when the apparatus is being charged, if the chain or rod D actuating the float C be separated from the bell, the float will rise freely in the water of the reservoir B, and cause the water-level therein to fall and the auxiliary float to act; allowing the necessary quantity of water for working to flow into the reservoir. This auxiliary float will also act automatically to re-establish the working level during operation, should the water fall below the predetermined limit.

Instead of arranging the generators in stages or cascade fashion, as fig. 1, independent generators may be employed, each fed with water from a corresponding reservoir provided with a float; and all the floats would be connected to the collapsible part of the holder in such a manner as to act successively. In such an arrangement, one or more water-reservoirs BB^1 (fig. 2) are arranged one above the other—the upper one first feeding water into its corresponding generator; and when the latter is exhausted, the bell of the holder falls sufficiently to carry down with it the rod or chain connected to the floats low enough to allow a tappet with which it is provided to bear upon the float of the next higher reservoir, so that it may act in its turn to deliver water into the corresponding generator. The arrangement might be inverted—that is to say, the connection might be fixed to the lower float in such a manner as to cause it to act first, and will be connected to the upper one by a chain or linked rod slack enough to allow the latter float to begin to be drawn down only when the bell of the holder moves to a lower level, which takes place when the first generator is exhausted.

Instead of arranging the reservoirs one above the other, they may be fixed side by side (as fig. 3), and a reservoir of water be divided into compartments, each provided with floats connected to the bell of the holder by chains or rods of different lengths and in such manner as to act in succession. Such an arrangement may be combined with that of the superposed generators in cases where the apparatus is provided with a large number of generating receptacles.

Acetylene Generator.—Campbell, C. H., of Philadelphia, U.S.A. No. 12,120; May 15, 1897.

The construction of this acetylene generator will be apparent from the following description of its mode of action: As the calcium carbide enters the generator A, and unites with the water therein, the resultant gas passes to the holder Y. As the latter rises, motion is communicated by the rack and pinion V to the shaft U, and thence to the collar Q, whereby the pawl on it rides freely over the ratchets, and imparts no motion to the conveyor E. When, however, the gas is used, the holder sinks, and motion is communicated in a reverse direction, so that the carbide is again supplied to the generator.



The generator is connected at its lower end with the box, which is adapted to receive the accumulation of spent carbide or sediment, and is fitted with a valve closed by the action of a lever. The holder is provided with a safety-valve K, to open when it rises at about its limit, so as to relieve any excess of volume of gas therein. The teeth of the rack do not extend continuously to the lower end of it; so that there is a blank which will prevent the operation of the pinion V, as the holder rises towards its limit.

APPLICATIONS FOR LETTERS PATENT.

19,910.—Rowden, W. T., "Internal combustion engines." Aug. 30.

19,951.—Chambault, L., "Generating and burning acetylene gas." Aug. 30.

20,010.—Dolan, E. J., "Gas-burners." Aug. 30.

20,011.—Dolan, E. J., "Acetylene gas generators." Aug. 31.

20,051.—Rhind, F., "Improvements in gas generating." Aug. 31.

20,052.—Rhind, F., "Gas generating lamps." Aug. 31.

20,116.—Cail, C. E., "Internal combustion engines." Sept. 1.

20,120.—Sugg, W. T., "Galleries for gas and other lamp globes and chimneys." Sept. 1.

20,142.—Kieffer, F. A., "Apparatus for the automatic supply of carbide of calcium in the production of acetylene gas." Sept. 1.

20,165.—Fletcher, T., Russell, W., and Fletcher, Russell, & Co., Ld., "Gas and similar stoves." Sept. 2.

20,184.—Dancer, W., "Production of gas for illuminating and heating purposes, and of certain bye-products." Sept. 2.

20,221.—Kiesewalter, A., "Incandescence bodies for gas and other burners." Sept. 2.

MISCELLANEOUS NEWS.

THE IPSWICH GAS COMPANY'S WORKS.

History of the Concern—A Large Scheme of Extension Commenced.

The visit of the Eastern Counties Gas Managers' Association to Ipswich last Thursday was regarded as an event of some importance in the town; and the local papers treated it as such. One of them—the "East Anglian Daily Times"—on the morning of the meeting gave up a column to an article on the history and present position of the Gas Company; and we have availed ourselves of it in preparing the following notice for our readers:—

The works were started, some time anterior to 1821, by Mr. J. T. Shewell (uncle to one of the present Directors, Mr. F. Corder) and Messrs. J. & R. Ransome, ironfounders. This firm wanted the new light for use in their small foundry; and, as no one else was prepared to take the matter up, the three gentlemen named subscribed a capital of £2400, and erected gas-making plant in a corner of the foundry. The public soon saw that gas was something very much better than oil, and applied to the promoters to be supplied with it. They were told that, if they were prepared to form a Company, the owners would hand the business over, and relinquish their rights; and the result was the formation of the Ipswich Gaslight Company. In 1821 an Act of Parliament was obtained; and works were erected on the present site. The price of gas at the outset was 15s. per 1000 cubic feet; and even at this high figure, the Company could not always pay full dividends. The first Engineer and Secretary of the Company was Mr. William Cubitt. He was followed by Mr. Daniel Poole Goddard, who was in turn succeeded by his son, Mr. Ebenezer Goddard. The last-named gentleman has the credit of having been one of the very first to use gas successfully for cooking and heating purposes. Mr. D. Ford Goddard succeeded his father in the management; and, on his retirement in 1887, the present Secretary and Engineer (Mr. J. T. Jolliffe) was appointed. Under the control of these gentlemen, and a strong Board of Directors, the Company has made steady progress, and yielded highly satisfactory returns to the shareholders. To keep pace with the increasing demand for gas, it was found necessary in 1847 to obtain additional parliamentary powers. An Act was passed authorizing the Company to increase their total share and loan capital to £35,000. Another Act was obtained in 1864, increasing the capital to £100,000; and a further Act in 1883, giving powers to increase the capital to £175,000. The sliding-scale clauses were introduced in this Act. In 1882 the Corporation sought to purchase the Company's works, and terms were provisionally agreed upon; but the burgesses declined to ratify the purchase.

In 1891, Mr. Jolliffe submitted to the Directors a scheme whereby the works would ultimately be made capable of producing 2½ million cubic feet of gas per day. The scheme was approved; and the Engineer was authorized to proceed with the work forthwith. Under this scheme the coal-stores have been rebuilt and enlarged, and are now capable of holding 6000 tons of coal. The number of retorts has been increased to 282; and it is in contemplation to add 108 more next year. The old engine and boiler houses have been removed, and a new and handsome block of buildings—comprising boiler, pump, exhauster, and meter houses—erected in their stead. Messrs. Cutler and Sons are now erecting a new holder, capable of containing a million cubic feet of gas; and next year, should it be necessary, a new purifying-house, with tar and liquor tank underneath, will be erected. Eventually, a third retort-house will be built; and a new lift added to each of the holders. The adoption of water-gas plant is also upon the *tapis*.

The new gasholder and tank are being built entirely of steel, and will weigh between 700 and 800 tons. In making the foundations for sustaining this weight, extra care was necessary on account of the nature of the ground. The site is on the bed of a creek, which once ran up to this point from the river; and so the excavations had to be carried down to the gravel. There are eleven cross walls of concrete 5 feet wide, varying in depth from 9 to 13 feet; and on the top of these walls are placed arches of concrete 3 feet in thickness. Up to the present time, the framing and the tank only have been put up. The framing is constructed on Messrs. Cutler's well-known system; and it rises from the ground level to a height of very nearly 150 feet. The tank is of 122 feet internal diameter, and 32 ft. 6 in. deep. The holder is to be of three lifts, of the following internal diameters: Outer lift, 120 ft.; middle, 117 ft. 9 in.; inner, 115 ft. 6 in.; and each will be about 31½ ft. deep. As already mentioned, the storage capacity will be a million cubic feet. The contract price for the holder is £10,500.

WILLSON'S PATENT FOR THE PRODUCTION OF CARBIDE OF CALCIUM.

An Alleged Infringement.

According to advices received last week from New Zealand, proceedings are pending in the Colony which are likely to determine the vexed question of whether the patent granted to Thomas Leopold Willson for the manufacture of calcium carbide in an electrical furnace can, in any true sense, be regarded as a "master patent."

The proceedings in question were before Mr. Justice Williams in chambers, who heard an application on behalf of Edmund F. Green, of Dunedin, and William Chilton Clark, of San Francisco, for an interlocutory injunction, directed against Walter Taine, of Dunedin, for the protection of the Australasian patent rights (assigned to them by Thomas Leopold Willson, of New York) for manufacturing and selling carbide of calcium for the production of acetylene. After a brief hearing, his Honour made an order to the effect that the motion was to stand over till the trial, without prejudice to any question; defendant undertaking to keep an account of all sales and profits made by him.

Matters are thus *sub judice;* but this does not prevent publication in the Colony (as it would in England) of documents bearing on the case. A New Zealand paper publishes the text of the affidavit filed by the defendant in opposition to an interim injunction being granted against him; also the affidavit, in reply, on behalf of the plaintiffs. These tend to show somewhat of the strength (as well as the weakness) of the case against the patent.

The defendant believes that he has at least two good grounds of defence to the action—want of novelty of the patent, or if there was any novelty in the invention, there was prior publication thereof in the Colony of New Zealand before the date of the application for the patent. To bear out his first contention, he quotes passages from an article, entitled "Carbide of Calcium," written by Wilhelm Borchers, Professor of Metallurgy and Technical Chemistry in the Royal Engineering and Metallurgical School at Duisberg, and published in 1895.

As more may be heard hereafter of this article, it will be as well to place on record in our columns some of its leading passages. Herr Borchers wrote as follows:—

"*Carbide of Calcium.*

"The publications of Mr. Willson and his friends in 1894 have aroused a very lively interest in this product and its manufacture. I obtained this product while experimenting to reduce the oxides of alkaline earth metals by electrically heated carbon about eight years ago; yet, looking for the metals themselves, I did not care at all for the dark residue I obtained in some of these experiments when using a surplus of carbon, though I observed the evolution of an ugly smelling and combustible gas (acetylene) when the product was thrown into water. If we are to talk about the process of manufacturing carbide of calcium, I must state that neither the Willson process nor any other of the lately patented processes is new. From the historical data on carbides, the truth of this statement will readily be confirmed.

"(1) In 1836, E. Davy (not Sir Humphry Davy) observed that the residue from the manufacture of potassium when thrown into water developed a combustible, badly-smelling gas—acetylene. This fact leaves no doubt that oxides of the alkali or alkaline earth metals, when reduced in presence of carbon, will furnish carbides of said metals.

"(2) In 1862, Wöhler, the well-known German chemist, succeeded in directly combining calcium and carbon, obtaining a carbide corresponding to the formula CaC_2 by heating an alloy of calcium and zinc in presence of carbon. He also recommended this carbide for the synthesis of acetylene.

"(3) In 1891, the author of this article published in the first edition of his book on electro-metallurgy that he had succeeded in reducing by electrically heated carbon all oxides theretofore considered to be unreducible. The following simple apparatus was used to demonstrate any of the reductions desired. [Here follows a description of the apparatus, illustrated with the diagram.]

"We will have to stop here a moment before continuing the history of carbides, in order to state that since 1891 the following two reactions have been publicly known: $CaO + C = Ca + CO$; $Ca + C_2 = CaC_2$. The latter chemical process was discovered by Wöhler in 1862; the former by Börchers in 1888 [published in 1891].

"If now we are considering the claims of Willson and of Moissan, not to speak of the commercially impossible processes of Maquenne and Travers, it is rather difficult to find any novelty in their mode of working. For what are they doing to obtain calcium carbide? They are heating electrically a mixture of calcium oxide and carbon; they are utilizing two reactions known since 1862 and 1891. Neither of these two reactions have been patented. Nobody is entitled to claim the exclusive use of these two well-known chemical reactions, no matter if the necessary heat is produced in the way described by Borchers, which kind of heating has been known since 1815, or by the electric arc, which has also been often applied in electro-metallurgy.

"In reply to the questions raised by the Editor of the 'Engineering and Mining Journal' lately, it may safely be stated that there can be no patents covering the substance calcium carbide or any other carbide, and that the production of calcium carbide [according to the reactions described above] in the electric arc furnace, as well as in other electric resistance furnaces, is free to anybody. There is a large number of works in Germany producing calcium carbide for sale, as well as for their own use, without paying royalty to patentees."

The defendant's affidavit next deals with his second line of objection to the patent—prior publication; and he says he can prove that before the application was made for the patent a description of the alleged invention had already been published in New Zealand. He says he has never manufactured any carbide of calcium, but has been importing small quantities of it during the last two years. The last quantity imported, and most of which he still has in stock (about 1 ton in weight) was manufactured, he believes, in France. To meet an assertion on behalf of the plaintiffs that they do not know of any attempt having been made to question the validity of the Willson patent, he quotes the following passages from an article entitled "The Calcium Carbide Gas Bubble," that was published in December, 1895, in the "Engineering and Mining Journal," of New York:—

"There are always many promoters (and at present they are more numerous than usual) lying in wait for the foolish public. There are mining bubbles, more or less like the Merced, each of which will cause greater loss than a hundred little 'wildcats' of the Cripple Creek variety, as Boston investors will in due time appreciate. It is well to warn constantly the credulous and avaricious investors against these things, and, in the interest of legitimate mining, to urge upon them to investigate, through reliable and disinterested sources, any investment of the kind before embarking in it. 'Wildcat' mines or mining bubbles are not, however, by any means the only worthless or dangerous baits now being offered. We have frequently referred in these columns to that interesting product, calcium carbide, of which a small quantity was produced in a kind of laboratory experimental way by the Willson Aluminium Company a year or so ago. That Company is now working on a large scale—not in making calcium carbide, of which it never produced a ton—but in selling rights to manufacture, and in collecting cash for such 'rights.' It is not our intention here to discuss the validity or worthlessness of the patents held by the Company, but we are advised that their validity is utterly denied by parties who claim to be ready and willing to go into the manufacture of calcium carbide regardless of them. We desire merely to warn investors of the risks they are running in buying either the 'rights' to use these patents or the stock of the Willson Company, which

we understand is quoted and has actually been sold at $1000 a share, the par value being $100. The Company recently received $300,000 cash as part payment for the rights it sold to a Chicago subsidiary company, and has paid a dividend of 60 per cent., and expects to pay another of 50 per cent. before long. And yet neither it nor anyone else has made a single ton of calcium carbide; and no one knows what the cost per ton would be, or what it will bring, or how many competitors would enter the field if its production afforded any large profit, nor the effect the producing of acetylene by the Fogerty process or some other would have. It is sufficient to point out that at present the scheme has all the indications of being at least a 'bubble'—a bubble of explosive gas (acetylene) which is liable to burst at any moment. Investors should, therefore, act with exceeding care."

The answering affidavit points out that Herr Borchers' book was published "long subsequent" to the date of Willson's patent (No. 7490; March 20, 1895); but even admitting that the production of calcium carbide in the electrical arc furnace is free to anybody, which he does not admit, he says that the production of calcium carbide by the process set forth in the patent "is and was the invention of Thomas Leopold Willson, and was not published prior to the said 20th day of March, 1895." The correct history of the invention by Willson was, it is claimed, given by Professor Vivian B. Lewes before the Society of Arts, in January, 1896, wherein Willson is given "full credit as being the first inventor of the said invention." [This was in Professor Lewes's paper, as published in the "JOURNAL" for Jan. 22, 1895, p. 168.] After averring that if the carbide in defendant's possession was purchased in France, it was made by the process described in the Willson patent, the affidavit concludes in these words: I was in New York at the time of the publication of the article quoted in defendant's affidavit, and I say that I know of 3 tons of carbide of calcium that were made by Willson's process, and shipped; and I believe that at that time many tons were similarly manufactured and shipped. In making the statements contained in a former affidavit I believed, and still believe, that the article published by the "Engineering and Mining Journal" was written falsely and maliciously, and in total ignorance of Willson's process, and of the fact that such process was a successful one; and I did not and do not consider the article to be a *bonâ fide* attack on the validity of the patent granted for the invention. Up to the time of the invention of Willson's process for the production of carbide of calcium and acetylene gas, as set forth in patent No. 7490 of 1895, the production of these substances was the subject of experimental research only.

And here we leave the matter for the present. The concluding words of the last sentence express what really appears to be the question for determination—whether the production of carbide of calcium previous to Willson's time was "the subject of experimental research only."

PROVINCIAL GAS COMPANIES.

The Ascot District Gas Company, in their half-yearly report, chronicle a profit for the half year of £1164, out of which it has been resolved to pay a dividend of 3½ per cent. The total quantity of gas sold amounted to 8,370,500 cubic feet, against 7,191,300 in the corresponding half of 1896. The Company have resolved to create new debenture stock of the value of £2700, bearing 4 per cent. interest; the new capital being required for the conversion of mortgages into debentures.

At the half-yearly meeting of the Dover Gas Company held last week, some interesting facts were given as to progress and increased prosperity. The Company started in 1822; and from the commencement till the end of 1846 the dividends paid were very fluctuating, and were derived from the supply of water. But in 1846 the Company were in a very bad condition, notwithstanding the fact that they were supplying water. They were practically bankrupt; for there was a sum of £425 on the wrong side. For some time they paid no dividend. In January, 1849, however, a change came over the Company. The price of gas then was 7s. 6d. per 1000 cubic feet; now it is 2s. 6d. The consumption was then 13¾ millions; now it is 180 millions. In the year 1860—the date when the Company obtained their first Act of Parliament—they paid by share and loan capital 18s. 3½d.; in 1884, it had been reduced to 12s. 4d.; and now it was 9s. 11d. The Company have been for some time paying a full parliamentary dividend of 7½ per cent. In 1884, the consumption of gas was 128 million cubic feet; during 1896, it was 172 millions. As regards the operations of the past half year, the Chairman stated that there had been a general and permanent growth in the Company's business. On June 30, the number of consumers was 2530, as against 2452 in the corresponding period of last year. The number of stoves and fires on hire was 801, as against 710. The number of meters in use was 2788, against 2639. The quantity of gas sold was 85,821,800 cubic feet, as against 82,793,500 cubic feet, being an increase of 3·66 per cent. A comparison of the figures in the profit and loss account as compared with those of the corresponding half, showed an increased revenue of £1134; an increased expenditure of £630; and an increased profit balance of £504. The total receipts were £15,901; and the expenditure £12,785—giving a profit for the half year of £3115, which would pay the usual dividend and leave £432 to be carried forward. During the half year 8355 tons of coal were used, or 235 tons in excess of the corresponding half. The gas produced was 92,116,000 cubic feet, or equal to 11,025 cubic feet per ton of coal; and 10,393 cubic feet of this was accounted for. The gas sold was equal to 10,272 cubic feet per ton of coal carbonized; and the leakage was down to 5·7 per cent.

Last week we briefly reported the proceedings at the annual meeting of the Falmouth Gas Company, held the previous Thursday; and Mr. J. W. Buckley, Assoc.M.Inst.C.E., the Engineer and Manager, has since sent some statistics regarding his working results in the year to June. The quantity of gas made was 35,143,100 cubic feet, being an increase over the previous year of 10·70 per cent. As 3415 tons of coal and cannel were carbonized, the make of gas per ton was 10,228 cubic feet. Gas sold to ordinary consumers totalled to 27,908,800 cubic feet; to coin-meter consumers, to 2,099,000 cubic feet; and 2,778,000 cubic feet were used in the public lamps. The unaccounted-for gas was 1,693,400 cubic feet, or 4·81 per cent. of the make. The Directors' report to the shareholders pointed out that (as was anticipated from the reduction made in the price of gas) the profit last year was less than in 1895-96. Nevertheless the shareholders had an interim dividend paid to them in February of 12½ per cent., and are now to have 13½ per cent., or an average of 13 per cent. over the year.

The Hastings and St. Leonards Gas Company held their half-yearly meeting on the 2nd inst.—Dr. G. G. Gray, J.P., in the chair. The Directors reported that the quantity of gas sold in the six months to June was 11,240,000 cubic feet (or 6·67 per cent.) more than the corresponding half of 1896. Unfortunately, the value of residuals did not improve—in fact, tar still further receded, while, under the new assessment of the Company's works, the rates largely increased. The accounts showed a profit balance of £8761; and the Directors recommended the statutory dividends of 13 per cent. per annum on the £25 shares, and 10 per cent. on the £20 shares. The Chairman, in the course of his speech, pointed out that the rental increased £1700 during last half year—the bulk of which was from private lighting. The cooking-stoves out on hire numbered 3428; and stoves for heating, 717—making a total of 3425, and showing an increase of 563 during the half year. The total number of prepayment meters on hire was 1491; and during the past year they had laid on 250 additional services. The consumers now numbered 7900, which was very satisfactory. As regards tar, they were in a somewhat peculiar situation. It would be obvious to all that they could not use all the tar they manufactured, and could practically send it to only one market—Portslade. The carriage was somewhat high; and the same price was charged whether the price of tar was high or low. Unfortunately for them, the price latterly had been low. This was due to one of the great companies, after having stored a large quantity, being obliged to throw it on the market. Therefore the market was low, and they had suffered at Hastings in consequence. During the six months, they had had to pay £305 more in rates and taxes—£1220 for rates in the half year. The Company was one of the largest, if not the largest ratepayer in the town; and they therefore had a big interest in the town concerning the rates. They paid something like 1¾d. in rates for every 1000 cubic feet of gas sold, and 2¾d. for coal dues. So that altogether they paid 4½d. to the Corporation on every 1000 cubic feet of gas. Consequently, instead of getting 3s. per 1000 cubic feet for the gas, the Company really only got 2s. 7½d., or omitting the coal dues 2s. 10½d. Therefore 12½ per cent. of the price received for gas went to the Corporation.

The annual report of the New Swindon Gas Company shows a profit of £2984 on the past year's working—an increase of nearly £400 on the previous twelve months. During the year 41,991,000 cubic feet of gas were sold, compared with 37,237,000 feet in 1895-96—an increase of 4,750,000 feet. This is the largest increase the Company have ever had in one year, and was due in a great measure to the introduction of slot-meters and to the development of the trade in gas-stoves. There had been an increase of 413 consumers during the year, and the value of gas sold was £7719. Dividends of 4½ per cent. on the preference shares, 10 per cent. on the ordinary stock, and 5 per cent. on the new ordinary stock have been declared.

The annual report of the Directors of the Sunderland Gas Company (which was noticed in the "JOURNAL" for the 31st ult.) was submitted to the shareholders by the Chairman, Mr. J. Stokoe, on the 1st inst.; and, in the course of his address, he showed that the business was expanding in a satisfactory degree. He pointed out that the quantity of gas made in the past year was 822,406,000 cubic feet, as against 758,476,000 feet in the previous twelve months; being an increase of 63,930,000 feet. The additional revenue was £5381; but this was nearly all absorbed by increases in the expenditure, amounting in the aggregate to £4982. In gas and meter rentals, there was an advance of £5192; and in residuals, £187. The extra expenditure was principally represented by: Wages, £1673; coal, lime, &c., £2163; and repairs, £1015. Referring to the completion of a new retort-house at the Hendon works, he said they had been at considerable outlay in effecting the alterations and in purchasing land. But the work had been very satisfactorily carried out; and they were ready to meet any increase in the demand that might be made upon them. In regard to the works at Ayre's Quay, which were the oldest the Company had, they were somewhat dilapidated; and it was necessary to spend a little money there. By the removal of some buildings, they would be able to obtain space sufficient for the erection of an additional retort-house. The population of the town was spreading rapidly in that direction, the demand for gas was increasing, and it was necessary they should have more plant to meet the growing demand. The report was adopted. A dividend of 5 per cent. on the original stock and 4¼ per cent. on the additional capital stock was then declared, in addition to the interim distribution in March last. A resolution was moved by Mr. Duncan, that in future the Directors should be allowed £750 instead of the remuneration of £500 paid them hitherto. In support of the motion, he said that for seventeen years past the Directors had been paid £500 per annum. In the course of this period, there had been an enormous development of their affairs. The make of gas had increased by 135 per cent., and the revenue by 75 per cent.; while the price of gas had been reduced by 30 per cent. The nine Directors of the Newcastle Company divided £1600 among them; in South Shields £500 was paid to seven; while in Sunderland they paid £500 to twelve. The proposition was heartily agreed to.

The half-yearly meeting of the Sutton (Surrey) Gas Company was held on the 30th ult. The report of the Directors stated that the balance of the profit and loss account was £7477, from which they recommend dividends at the rate of 10 per cent. per annum on the original and 7 per cent. on the paid-up additional capital. The Directors with profound regret recorded the loss they personally, and the Company, have sustained in the death "of their esteemed friend and colleague, Mr. Frank Mead; and they would wish, as a lasting tribute, to place in the annals of the Company their expressions of the high esteem in which they held him as a friend, and also as Secretary and Engineer of this Company, to whose efforts and exceptional ability the success of the Company is so largely attributable." The Directors mentioned that they had appointed Mr. G. Mead Robins as Secretary and Engineer (not "Secretary and Manager," as was inadvertently mentioned in our columns last week), who, for the past thirteen years, has been working with and under the late Mr. Mead. Owing to the increase in the Company's business, further storage capacity has been necessary; and a new gasholder, to contain one million cubic feet, is now in course of construction, under the direction of Mr. F. S. Cripps. The death of Mr. C. R. Mead, the previous Friday, was naturally referred to at the meeting by the Chairman, Mr. F. Bugden. He

said that, by the death of their friend and colleague, Mr. C. R. Mead, they had lost a good friend, and the Company had suffered an irreparable loss. The time, attention, and ability that he had given to the Company none of them could estimate; and he (the speaker) was sure that they all most truly sympathized with his widow and relatives in the loss they had sustained. This loss, as they were aware, came upon them after the death of their Secretary, Mr. Frank Mead. In him they had a gentleman of unusual abilities and unusual powers; and the success of the Company since Mr. C. R. Mead gave up the management of it, was very largely due to his son's devoted services. It was seldom that a body of shareholders met with so severe a loss as they had suffered during the last six months. After a vote of sympathy with Mrs. Mead had been duly passed, the motion for the adoption of the report and accounts was made. The Chairman pointed out that the Company were in such a satisfactory condition that the Board had felt the necessity of increasing their storage, and were having a holder erected of a capacity of a million cubic feet. He thought it was only prudent on their part to take care that their business did not stand still for lack of storage. Allusion was, he said, made in the report to the death of their late Secretary, Mr. Frank Mead; and the Directors had appointed in his place Mr. George Mead Robins, who was a grandson of their late Chairman, and who had spent many years of his life in connection with his grandfather and uncle at the Bournemouth and Sutton works. They had every reason to believe that he would look after the business of the Company thoroughly well, and that he was in every way competent. He hoped that they might continue to have a prosperous career under his management. The report having been passed, and the dividends as recommended declared, an extraordinary meeting was held for the purpose of authorizing the Directors to raise additional share capital or debentures (together amounting to £10,000), in accordance with the provisions of the Sutton Gas Act, 1876. The Chairman explained that the money was needed to pay for the new holder and tank. It was their intention to raise a certain part of it by 7 per cent. shares, and the remainder by 4 per cent. debentures. The new shares would be distributed among the shareholders *pro ratâ*. The debentures would be offered to the shareholders; and if they had applications for more than they proposed to issue, then they would be distributed *pro ratâ* also. The proposals of the Directors were approved. A vote of thanks to the Directors, Secretary, and staff concluded the meeting.

The report and balance-sheet of the Tonbridge Gas Company were adopted at the half-yearly meeting on the 6th inst., and dividends at the rate of 11¼, 8¼, and 5 per cent. on the several stocks of the Company were declared. The profit on the six months' working was £1317, which added to the balance of £2773 left £4090 available for dividend. The consumption of gas continues to increase very rapidly; the increase for the half year being 3,627,000 cubic feet, or 18·5 per cent. The demand for cooking and heating appliances is as great as ever; and applications for prepayment meters are very numerous. The Chairman (Mr. J. Fagg) referred to the loss sustained by the Company by the death of Mr. J. Collins, who had been the Chairman for 28 years. He also enlarged on the increase in the Company's business; saying that, although the price of gas had been reduced by 2d. per 1000 cubic feet for three years in succession, they had been able to pay increased dividends and carry forward £200. A hearty vote of thanks to the Chairman and Directors for the care and attention they had bestowed on the Company's business was passed; also one to the Engineer and Secretary, Mr. James Donaldson.

At the annual meeting of the Woking Gas Company last Friday, it was reported that the revenue amounted to £3123, and the expenses to £1982; leaving a net profit of £1141. It was also announced that the Directors had given notice of a reduction in the price of gas from 4s. 6d. to 4s. 3d. per 1000 cubic feet to take effect from Oct. 1. The report was adopted; and a dividend of 5 per cent. was declared.

HARROW AND STANMORE GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. James Glaisher, F.R.S., in the chair.

The Secretary and Engineer (Mr. J. L. Chapman) read the advertisement convening the meeting; and the Directors' report and the accounts, which were noticed in last week's issue, were taken as read.

The Chairman, in moving the adoption of the report, first referred to the manufacturing results of the half year. He said the quantity of coal carbonized was 2753 tons; being 89 tons more than in the corresponding period of 1896. The amount of gas made was 28,438,000 cubic feet, or an increase of 1,417,000 feet. The production per ton of coal carbonized was 10,330 feet. On the works 350,000 feet were used; and the quantity unaccounted for was 1,862,000 cubic feet—being 6½ per cent. on the make, or ½ per cent. less than in the June half of last year. They sold 26,226,000 cubic feet; being at the rate of 9526 feet per ton of coal. Last year in the same period they sold 9221 feet per ton; so that they had improved by more than 300 feet. Turning to the accounts, he found they had spent £270 more in the manufacturing department; but under the other heads of expenditure there was very little difference in the items. The total expenditure was £4666; being £260 more than in the corresponding half of last year. Regarding the receipts, they had had an increase of £325 in the income from the sale of gas, or equal to nearly 6 per cent. The meter and stove rental had advanced by about £46; and for coke an additional £70 had been received. There had been a diminution in the return from sulphate of ammonia. He found they had made 1 ton of sulphate from every 100 tons of coal carbonized; so that the reduction was not due to the make, but to the price obtained for the product. The total income was £6991; being an increase of £425. The profit therefore amounted to £2325, which was £164 more than in the first half of the year 1896. The second paragraph in the Directors' report related to the construction of a new gasholder. Their storage capacity at the present time was only 150,000 cubic feet; while sometimes in winter they were sending out 300,000 feet a day. As they now made and stored all the gas at Harrow, it became a really critical question whether they could longer defer having additional storage accommodation. The Directors considered the time had now arrived when it was imperative they should have a new holder; and one was now being constructed to contain 350,000 cubic feet.

Mr. A. H. Baynes seconded the motion, which was carried.

Dividends were declared at the rates of 7½ per cent. per annum on the original "A" capital, 7 per cent. on the "B" capital, 5½ per cent. on the "C" capital, and 6 per cent. on the guaranteed shares.

A vote of thanks having been passed to the Secretary and Engineer,

Mr. Chapman, in responding, expressed his satisfaction at the prospect of the new railway coming close to the works. It would be a vast saving to the Company, and would enable them to increase the business, reduce the price of gas, and pay a better dividend.

Mr. A. F. Phillips, in proposing a vote of thanks to the Chairman and Directors, remarked that it was gratifying to find that the consumption of gas continued to increase throughout the district, and it was especially so at Harrow, where they had competition with the electric light.

Mr. Taylor seconded the motion, which was heartily agreed to.

The Chairman, having acknowledged the vote, reverted to the question of the carriage of coal. He said that, if they bought their coal at the same price at the pit mouth as a London Company, the latter could get the coal placed upon their wharves for a little more than 3s. per ton, while it cost 9s. to have it conveyed to the Harrow works. In addition, they had the horses to keep, and the men to pay. In the past, this had caused them some difficulty; but he believed it would be lessened very much by the new railway.

The proceedings then terminated.

COLONIAL GAS UNDERTAKINGS.

Reports have lately reached us from the following Colonial Gas Companies; and we extract therefrom a few particulars showing the progress of the undertakings.

From the Secretary of the Australian Gaslight Company (Mr. R. J. Lukey), we have received a copy of the report of the Directors presented at the annual general meeting of shareholders on July 26. It stated that the net profits for the six months ending June 30 amounted, with the balance brought forward (£5728), to £54,164. This enabled them to recommend the payment of a dividend of 9s. per share free of income-tax. This would absorb £51,135, and leave a balance of £3029 to be carried forward. The revenue from the sale of gas, &c., amounted to £147,047; the total expenditure being £98,611. The installation of incandescent gas-burners in the public lamps of Sydney, already referred to in the "Journal," was completed in March; and it has been giving great satisfaction. Similar burners are being fitted in the suburban lamps; and it is hoped that by the end of the year the whole of the Company's public lighting will be upon the new system. In submitting the report for adoption, Mr. G. J. Cohen said there had been a reduction in the expenditure as compared with the corresponding period of last year. The economies thus effected had enabled the Directors to reduce the price of gas to the private consumers and for the public lamps. Alluding to the installation of incandescent burners in the city at the Company's cost, he remarked that, though a superior light was given with a consumption of 3½ cubic feet instead of 4 feet of gas per hour in the old burners, it was a mistake to suppose that this would make the cost of the lamps less for the Company, as the saving of 6s. per lamp per annum in gas would be more than counterbalanced by an expenditure of 9s. per lamp—the estimated annual cost of the renewal of the mantles. The Directors proposed, as an experiment, to introduce prepayment meters in Balmain, and would fit up small houses on the present line of main for (say) three lights and a gas-ring free of cost, with a meter, and charge a small increased rate to cover the cost not incurred in ordinary connections. The quantity of gas delivered for 1d. would be 16 cubic feet. The main and service pipes now laid amounted to 1164 miles; the number of public lights was 9953; and of cookers, 7618. The total number of consumers was 34,557. The report was adopted. Approval was expressed by several shareholders of the policy of the Board in improving the public lighting, and in allowing the economies effected to accrue to the benefit of consumers in reduction of the price of gas. As was recently mentioned in the "Journal," the Company are treating the question of street lighting with unusual enterprise and liberality. Yielding to a desire expressed by the authorities, the Company have for some months past been engaged in installing incandescent gas lights in the city and suburban lamps; and they are doing this free of charge to the Councils, though the cost to the Company will be not less than £10,000. Business people, if treated in such liberal fashion, would no doubt feel thankful; but some Councils do not seem burdened with a sense of gratitude, and consider that the Company should not only install the new light for nothing and maintain it without extra charge, but should also reduce the price per lamp; as it is said that the adoption and use of the new burners will effect a great saving to the Company. But such is not the fact. In the first place, the Company are put to an initial expense of £10,000—the installation, with the necessary alteration of lamps, &c., costing about £1 a lamp, on 10,000 lamps. The amount of gas consumed in the public lamps has hitherto been much greater than the contract quantity, which is 4 cubic feet per hour. With the new light, the consumption will be 3½ feet per hour; but the saving on the actual, as against the contract, consumption is trifling, and will by no means cover the cost of installation and additional and constant expense of maintenance.

The Maryborough (Queensland) Gas Company, Limited, received from the sale of gas, fittings, stoves, &c., in the half year ending June 30, £2896; from residuals, £153—the balance brought forward making up a total of £4112. There was at the close of the above-named period a balance of £1067, which the Directors recommended should be used in the payment of a dividend at the rate of 6½ per cent. per annum. This would absorb £834, and leave a balance of £233.

The Perth (Western Australia) Gas Company, Limited, realized a net profit of £8449 in the year ending May 31. Adding the balance brought forward (£572) made £9021, which the Directors proposed to appropriate as follows: Payment of a dividend for the half year at the rate of 10 per cent. per annum, £3700; a bonus at the rate of 5 per cent., £1850; addition to reserve fund (increasing it to £12,000), £2000—carrying forward £1471. The Company supply both gas and electric light. New machinery for the production of both illuminants has been fitted up at a

cost of £18,168, and is working satisfactorily; thus enabling the Directors to meet the increasing demand. They recommended a further reduction of 10d. per 1000 cubic feet in the price of gas. According to the report of the Manager (Mr. E. Wigglesworth) the sale of gas was 52 per cent., and of electricity 42 per cent., more than in the previous year; and the accounts show that the revenue from the former was £16,525, and from the latter £3329, inclusive of the receipts for residuals, fittings, &c. A project is on foot, and awaits confirmation by the shareholders at an extraordinary meeting to be held next month, to sell the undertaking to Mr. Z. Lane for £111,000; this being at the rate of £3 per share on the present capital.

AN AMERICAN "GAS FIGHT."

Warring Combinations of Capital—Story of the Financiering of the Properties.

The "Financial News" for Thursday last contained the following article under the above headings:—

The Indiana gas-field is just now the scene of a pretty fight between opposing combinations of capital. The particular storm-centres at present are Indianapolis and Peru; but the plan of battle is comprehensive, and involves all that part of Indiana where natural gas is sold for private consumption. When natural gas was first discovered in Indiana, the Standard Oil interests and the coterie of capitalists known as the Brice Syndicate were prominent in its development. But it was too uncertain a matter for heavy investments; and the great bulk of the work of developing and piping the gas to the cities in the vicinity of the field fell upon those who had undertaken to do the work with popular subscriptions. The business proved enormously profitable, and it built up a number of considerable fortunes. In 1890, according to the "New York Tribune," E. C. Benedict and his friends, commonly known as the "Benedict Crowd," the "Jerzmanowski Syndicate," and the "Central Trust Clique," turned their attention to natural gas. They had been in artificial gas for years, and their operations in New York Consolidated Gas, Chicago Gas, Welsbach Light, and other similar corporations, are well known to the financial world. Like all conservative capitalists, they were afraid of natural gas, but thought it well worth while to try the experiment in Indianapolis, where a fuel-gas plant would probably be valuable, even after the exhaustion of natural gas. Then they had a theory that a single corporation conducting the artificial and natural gas plants of a city could practise certain economies and make money.

"In Indianapolis," says a special dispatch on the subject, "the artificial gas plant and one of the two natural gas plants were owned practically by the same people. An agent from New York purchased the two for £400,000. It was said at the time that the purchasers were the Jerzmanowski Syndicate; but Baron Jerzmanowski soon retired to the background, and C. F. Dieterich came to the front as the head of the Syndicate. The thing was an experiment; and Jerzmanowski had grown too rich to have his name connected with a failure. While a few financiers have known that Benedict, the Fergusons, and others of the 'Benedict Crowd' were behind the deal, the general public has known nobody else in it than the Dieterich Syndicate. When the deal was first begun, Dieterich was not a capitalist of any magnitude, but was a gas expert who had long been in the employ of the Benedict people. The Indianapolis experiment worked well. After paying £400,000 for the plant, the speculators bonded it for £530,000, and let the bonds go to brokers at 90, with a bonus of £60 stock with every £200 bond. The stock was £400,000; so that the sale of all the bonds with this bonus still left the promoters enough stock to control. The bonds went to customers at 95. They are thirty-year 6 per cents. The interest has been promptly met; and the stock has paid a dividend of 12 per cent. right along. The bonds were issued in 1890, and all floated by 1892; and the Syndicate was ready to widen its operations in the Indiana field.

"Within the next three years, the artificial and natural gas plants in nearly all the larger towns in the northern part of the State were bought up, and the same policy followed at Indianapolis was pursued. They paid liberal prices for the properties, but they loaded them still more heavily with securities, and have always succeeded in getting rid of the bonds. Mr. Brice and his associates were heavily interested in most of these properties, and thought that they were unloading them at tremendous figures. But when they saw with what ease the new purchasers floated their bonds, they got it into their heads that they had sold out too cheap. Mr. Brice very early found out what the new move meant, and, after allowing the new-comers to make half their purchases, squeezed them hard on the properties that were necessary to complete the scheme. However, the Benedict people went merrily on. The plants at Lebanon, Frankfort, and Crawfordsville, both artificial and natural, were taken in and reorganized as the Indiana Gas Company, with £200,000 of bonds and £200,000 of stock. In bonding these new properties, they went a little farther than they did in Indianapolis, and gave them a wider margin over the purchase price. Next, the plants at Logansport, Peru, and Decatur were taken in and organized as the Logansport and Wabash Valley Gas Company, with bonds of £350,000 and stock of the same amount. Mr. Brice permitted them to buy up Peru, Wabash, and Decatur before his agent would talk about Logansport; and then, after they had issued their notices of the proposed reorganization, the price of the Logansport plant jumped at the rate of £2000 a day while the negotiations were in progress.

"Then they advanced upon Lafayette. Here the stock in the plants was widely distributed, and it cost them about £140,000 to gather it in. The concern was floated, however, with £200,000 of bonds and the same amount of stock. Then came the last and largest purchase outside of Indianapolis. The Fort Wayne and Bluffton plants were purchased and consolidated, with £500,000 of bonds and £500,000 of stock. Some of these properties have paid better than others; but the interest upon all the bonds has been promptly met, and the stocks have yielded from 8 to 12 per cent. Upon these properties, which cost the Syndicate about £1,100,000 in cash, they have issued £1,780,000 in bonds and £1,600,000 in stock. They have floated the bonds, getting 90 for them, and have given along with them some £520,000 in bonuses; cleaning up a profit of about £500,000 cash, and still retaining over £1,000,000 of the stock—enough to control the properties.

"All this money-making has excited some envy; and during the last year a strong combination has been effected to 'bear' these securities. It is composed largely of the people who sold these plants to the Syndicate. The head and front of it is Allen M. Fletcher, who was almost the sole owner of the gas properties. He and his brother are private bankers, with a reputed fortune of about £600,000; and they have with them the Frenzel group of bankers, representing another large aggregation of capital. Through the local newspapers at Indianapolis and in other cities, they have raised the cry of cheaper gas, with such effect that both political parties took it up in Indianapolis, and the Council passed an ordinance reducing the price of artificial gas from $1.25 to 75c. per 1000 cubic feet. The Company resisted this in the Federal Courts, and obtained a temporary injunction against the enforcement of the ordinance by giving a bond to ensure rebates if the case goes against them. In Peru, the franchise is about to expire; and they are holding public meetings to impress the Council that gas must be cheaper. At the same time, the agitation is going on in all the other cities, and the bear campaign is active all along the line. It is a very pretty fight; and it seems evident that the people should finally obtain cheaper gas through it."

Gas-Stoves on the Hire-Purchase System.—The Sowerby Bridge District Council have resolved to let out gas-stoves on the three years' hire-purchase system. The payments are to be made quarterly, on the basis of 15 per cent. of the gross price.

The National Union of Gas Workers and General Labourers, in its annual report from March 31, 1896, to June 30, 1897, shows an increase of members from 25,240 to 35,333. This Union of unskilled men is said to be the ninth strongest in the country; and its General Secretary, Mr. Thorne, has been President this year of the Parliamentary Committee of the Trades Union Congress whose meetings have just been held in Birmingham.

Proposed Acquisition of the Filey Water and Gas Company's Works by the District Council.—The Filey District Council resolved last Tuesday to hold a special meeting on the 28th inst., to consider the advisability of promoting an Act of Parliament, having for its object the compulsory purchase of the Filey Water and Gas Company's works. A letter was read from the Secretary of the Company stating, in reply to a letter from the Clerk, that the Directors are not prepared to state any terms, or entertain any proposal to purchase their undertaking.

Proposals for Improving the Water Supply of Warrington.—Two members of the Warrington Corporation Water Committee (Messrs. Lee and Evans) and the Water Engineer (Mr. James Deas) have lately visited some of the works of the London Water Companies in order to collect information to guide them in making recommendations as to augmenting the existing supply of Stockton Heath, Higher and Lower Walton, Latchford, Grappenhall, Moore, and Daresbury. As a result of their investigations, they submit four schemes; but the one proposed for acceptance is estimated to cost £6168, and consists in the construction of a tank and pumps to the reservoir at Stockton Heath.

The Price of Gas in the Out-Districts of Manchester.—The resolution in this matter (referred to last week, p. 545) came before the Withington Urban District Council at their meeting on Thursday. Mr. Blackstock moved that the report be referred back to the Committee. He objected to the Council placing themselves in antagonism to the Manchester City Council. Mr. Raby said if the Council adopted the report they would not be defying the Corporation. The Council had a right to seek redress for the ratepayers in what was admittedly an exorbitant charge for gas. On a vote being taken, the motion was defeated. The report was then approved, and a Committee of eight members was appointed to represent the Council at the proposed conference.

A Water Diviner's Fees.—Notwithstanding recent decisions of the Local Government Board auditors, who have disallowed such fees when paid, the Higham Ferrers (Northamptonshire) Town Council, last Tuesday ordered payment of a bill for £3 12s. for water-divining. Dealing with this subject at a recent meeting, the Newton Abbot Rural District Council considered a letter from a water diviner who has been employed to "find" a water supply for the village of Kingskerswell. He wrote that he only judged the approximate depth and yield of water when he was requested to take on a job of well-sinking or boring for water on terms of "no cure no pay." His guarantee at the site suggested for the boring for the supply of Kingskerswell was 15,000 gallons per day at a depth not exceeding 130 feet. He said: "If I fail to obtain that quantity of water, I get no pay; but if I exceed the depth of 130 feet and continue the work at my own expense, and in the end find the quantity of water guaranteed, then I am to be paid for the 130 feet agreed upon." He offered to send in an estimate of cost; and the Council decided to ask him for one. It was suggested that he would probably "require double" for taking the risk; and one of the members expressed the opinion that it was an unbusiness-like proceeding.

The Water Supply of Bollington.—A Local Government Board inquiry was held last Wednesday by Colonel A. C. Smith, R.E., into an application by the Bollington Urban District Council to borrow £7700 for a water supply scheme. The population at the last census was 3962, with an assessable value of £10,744. It was pointed out by an Inspector of the Local Government Board so long ago as 1873, that the water supply of Bollington was altogether inadequate; and since 1879 six or seven schemes have been before the Council for their consideration. Ultimately they obtained the advice of Professor Boyd-Dawkins, as to the best site for a water-works; and, on his advice, works were commenced at Rainow, and are now all but completed, with the exception of laying pipes to the village, which is between two and three miles from the site of the water-works. Mr. C. Blunt, Clerk to the Board, placed the facts before the Inspector, and Mr. W. H. Radford, Engineer for the scheme, explained it in detail, together with a supplementary scheme, which he advised them to carry out, to meet exigencies which might occur in case of a severe drought. The total cost of the works was estimated at £7700. It was pointed out that at the present time, according to tests which had been taken, there was an available supply of water at the works of 112,800 gallons per day. At the close of the inquiry, the Inspector visited the site of the works, and also that of the proposed supplementary scheme at Whiteley Green.

BURTON-ON-TRENT CORPORATION GAS SUPPLY.

A Further Reduction in Price.

The Monthly Meeting of the Burton Town Council was held on Wednesday—the Mayor in the chair—when some interesting details transpired as to the progress of the gas undertaking under Corporation control.

Alderman Lowe (the Chairman of the Gas Committee) moved a resolution to the effect that the price of gas should be reduced to 2s. 5d. and 2s. 7d. per 1000 cubic feet for consumers in the borough, 3s. 1d. for Bretby Hall, and 3s. 9d. for Newton-Solney. In the course of his remarks, he said there was no need in these days to advocate the policy that all public works—such as gas, water, and tramways—should be in the hands of corporations. To do so would simply be "to point the moral" of an "adorned tale." They had regretted in the past, and always would regret that the water supply of the town was not managed and controlled by the Corporation; and the benefit which would have accrued to the town had this been the case was universally recognized. What might have been obtained for a mere song, or a very nominal sum, was now in the hands of a wealthy and powerful Company; and they had no chance of acquiring the undertaking except by the payment of a very large sum indeed. Happily, however, those who lived before the present generation very wisely secured possession of their own gas-works. The Corporation were the sole proprietors of this business, which was a very profitable one, and of immense advantage to the town. He had been very much interested in looking over the documents dealing with the progress of the works. He found that in 1872—twenty-five years ago—the amount of gas sold was 66,523,000 cubic feet; while in 1878, a year which marked an epoch in their town as being the year in which it became a municipal borough, the amount had increased to 115,842,000 cubic feet—the total revenue from this source then being £25,541 13s. 7d. In 1885-86, the consumption had advanced to 166,575,300 cubic feet—the revenue having steadily increased to £32,011. At this point (1885-6) the Committee, through its then Chairman (Alderman Matthews), proposed that the works should be extended; and that for this reason the sum of £40,000 should be borrowed. This proposal was strenuously opposed by many of the leading members of the Council, who based their attitude upon the depressed state of the staple trade of the town, and the possible introduction, sooner or later—and sooner rather than later—of the electric light. It was said eleven or twelve years ago that gas was a failing light, and there would be a gradual decrease in consumption. The only observation he had to make upon this matter was an old one, and yet a perfectly true one—viz., "Never prophecy unless you know." In 1897, the amount of gas consumed was 247,501,000 cubic feet; and the total revenue, £42,380. So that in the period which had elapsed since the town was incorporated, the gas made and sold had doubled at the very least; and it was very gratifying to know that this had been the case. What was said as to the depression in the staple trade and the competition of the electric light alarmed some of them. From 1879 to 1881 the price was 3s. 4d. per 1000 cubic feet to the largest consumer, and 3s. 6d. to the general public. From 1882 to 1889, it stood at 2s. 10d. and 3s., after which it was reduced to 2s. 7d. and 2s. 9d. At this price it had remained up to the present time, with the exception of one year, when the great coal strike and its accompanying coal famine caused it to be raised to 3s. for all consumers alike. The present resolution was to further reduce the price to 2s. 5d. and 2s. 7d. per 1000 cubic feet; and the reduction would affect not only the borough, but also the outside consumers. By the resolution passed a few months ago, the number of consumers had been increased in consequence of the penny-in-the-slot system, which had proved a great boon, especially to the small cottage occupiers. It was perfectly true they paid at a higher rate than the ordinary customers; but taking all the circumstances into consideration, he thought it was as fair and equitable an arrangement as that affecting those who paid the lower prices. Another concession which had been made, but which might have been almost forgotten, was the reduction in meter-rents. The result of this was that whereas in 1879, with 3034 customers, the revenue was £1150, it was now only £482 with 4552 customers. Taken altogether, the record of the Gas Department was one of which they as a Corporation had good reason to be proud. They had provided their customers with a good light, and had also benefited the town at large in many other ways. He believed there were differences of opinion as to whether the price should now be lowered or not. He should like to remind the members that since the incorporation of the borough a sum not less than from £90,000 to £95,000 had been voted out of the gas profits in aid of the rates. Then £10,000 had been devoted to the purchase of the sewage farm, more than £5000 to the flood works—works which had on all hands been recognized as of great and permanent value to the town, and which had not cost them a single sixpence; and £6250 had gone in the purchase of the Park Hill Estate. By the aid of the gas profits funds had been provided for the carrying out of important works, some of which, he did not hesitate to say, would not have been possible without them, as they could not have been legally paid for out of the rates. He had been in Burton long enough to remember that the price of gas was at one time much higher than it was at present—viz., 12s. 6d. per 1000 cubic feet; and he would not attempt to tell them what sort of gas it was at that. At any rate, it was a very different article to that supplied to them by Mr. Ramsden to-day. It was said that the Committee's recommendation did not meet with universal approval in the Council. It was thought by some that the price was low enough already, and ought not to be reduced at all; while others thought it should be 2s. 4d. and 2s. 6d. He claimed that the recommendation of the Committee was the happy mean between the contending forces. He could not agree with those who asserted that the gas should be sold at the cost of production; and he was prepared to argue in the opposite direction. Such a proposal would be unreasonable, unfair, and unjust. The works were the property of the town as a whole, and not of the consumers alone; and the town as a whole should have a fair share of the profits. Let him remind them that the sum of £150,000 had been borrowed by the Commissioners on the security of the rates for the erection of the gas-works. He was glad that the sum had been reduced to £57,000. But if a failure had occurred with respect to the use of gas as an illuminant, who would have had to bear the loss? Not the consumers alone, but the town as a whole; and especially those who would feel it most—viz., the small property owners. He believed in reciprocity, but not a reciprocity which was all on one side; and he was not a disciple of the school who held that the consumers alone should receive the profits. He believed that the consumers should have every reasonable concession, and maintained that when the gas was sold at 2s. 5d. and 2s. 7d., and meters were let at nominal prices, the residue of the profits (which could not be large) should be shared equally by the small owners and occupiers. It was estimated that the carrying of the resolution would involve a withdrawal of about £2000, but this would leave over £4000 for other purposes. His own opinion was that, with the increased consumption of gas which the decrease in the price would secure, they would have at least £5000 available for the relief of the rates. In addition, they had a reserve fund of £20,000; so that he did not think there was anything in the proposed reduction to alarm the general body of ratepayers. While talking about the relative price of gas, it was only fair to call attention to the fact that during the whole of the time the rates of the town had continued to increase. In 1879, the borough rate (he was speaking only of the poor rate) was 3s. 4d. in the pound on an assessment of £175,525; while it was now 5s. 1½d. on an assessment of £252,338. The Borough Accountant had stated that the local rates were very heavy indeed—among the highest in the Kingdom. In 64 towns the average was 5s. 11d., while Burton was 6s. 5½d. The price of gas, on the other hand, was 2s. 6d. per 1000 cubic feet; so that if the reduction proposed was made, it would bring it to the average of the other 64 towns. There was only one other point to which he would refer. It had been suggested that the wealthy brewers of the town should forego the concession of 2d. proposed in the resolution, and allow it to go towards the relief of the expenditure involved in the sewerage scheme; and he should be glad to hear that they were prepared to adopt the suggestion.

Mr. Turner having seconded the resolution,

Mr. Lathbury opposed it. He said the greater part of Alderman Lowe's argument went to prove that the resolution was scarcely acceptable even to himself. If the price of gas were reduced, the rates must increase. He looked upon the gas-works as the property of every ratepayer of the town; and everyone had a right to profit by them. Unless the estimates of the various Committees were reduced, the money required must be found elsewhere. Had anyone grumbled at the present price of gas? He had not heard of any complaints, nor had he seen anything in the local papers in reference to the matter.

Mr. Bassett, a member of the Gas Committee, also opposed the motion, though he was not against a reduction in the price of gas. Personally, he should like the reduction to go on until the gas was as free to them as the air they breathed; but he was opposed to the inevitable reduction in the cost of production, and in the amount available for the relief of the rates. He thought the present a most inopportune time to bring forward a resolution of this kind, inasmuch as the cost of production would be rather more than in previous years; while the Gas Manager had assured them that the amount likely to be obtained from the sale of residuals would be less than heretofore. Under these circumstances, the proposition was hardly feasible from a business point of view. Then, again, he had not heard any allegation that they were making an exorbitant profit, seeing that they had laid out £150,000; and unless Alderman Lowe could assure him that there would be no addition to the rates, he should vote against the resolution.

Alderman Wilkinson said he had a great deal of sympathy with the views just expressed, and came prepared to vote against the resolution; but after hearing what Alderman Lowe told them—that there would still be £4000 or £5000 available for general purposes—he had made up his mind to support it. He thought the margin between the price charged at Burton and other places like Nottingham was too large, and that the reduction proposed was a very fair settlement.

Mr. Auty was in favour of the recommendation, but would sooner have had a reduction of 3d. than 2d., because he could not see the fairness or justice of making the gas consumers give up so much of the profits. He could not go so far as to say that there would be no increase in the rates; but he did not think it would amount to 2d. in the pound. He did not believe that the consumers of gas should pay from their profits towards the reduction of the rates of others. Take the South Staffordshire Water-Works Company for instance. The Council would not think they were entitled to any undue consideration. The Company used no gas at all; but supposing the rates were increased 2d. in the pound, they would have to pay £16 17s. 4d. in aid of the rates. He thought one of the classes entitled to as much consideration as possible was the small consumers. On the other hand, if the alteration did result in an additional rate, the brewers would be the greatest sufferers. He was not one of those who contended that all the profits should go to the consumers; but he thought that if the reduction suggested was agreed to there would still be a good margin, as he certainly did not anticipate that the profits would be less than they were last year.

Mr. Thompson contended that if the small tradesmen had to pay an increased rate of 2d. in the pound as a result of the reduction of 2d. in the price of gas, they would be worse off than they were now. Alderman Lowe had told them that the profits on the gas-works were £6000, which was only a return of 4 per cent. on their capital outlay. If the resolution were carried, however, and the profit only reached £4000, the percentage would not, he contended, be such as the Council, who worked the department for the benefit of the whole town, ought to be able to hand over to their shareholders. As the gas-works belonged to the whole town, they ought to be conducted so as to give the community at large a greater return for their money than 3 per cent.

Alderman Evershed, M.P., confessed that when he saw it was proposed that the price of gas should be lowered, he thought that the Committee were taking a step in the wrong direction, as the proposal, however they looked at it, meant a reduction in their income of some £2000. Of course, there were a good many things to take into consideration in dealing with a question of this kind; and the Committee should know better than outsiders whether, after balancing all circumstances, the reduction suggested was justifiable. He (the speaker) was not at all so sanguine as some of them seemed to be as to future profits. There was no doubt a close connection between the price of gas and the amount of the rates; and the more they lowered the price of gas, the greater the tendency was to a rise in the rates. The gas-works had been a splendid source of income to the town in the past; but although

the price of the commodity had been higher than it was now, it had not prevented increases in the rates—or in the use of gas. Alderman Lowe had mentioned a good many things that had been done by means of the gas profits; and he (the speaker) thought such a consideration must have been somewhat of a stumbling-block to Alderman Lowe when he was moving a resolution which would have the effect of reducing the amount available for similar purposes in the future. He (Alderman Evershed) could not agree with Mr. Auty when the latter said that those who did not use the gas should not be benefited by those who did. If the gas-works did make a profit, the profit was spent in things which benefited all. He was against any reduction, because there had been no request from any quarter for such reduction; and it was somewhat unusual for a public body to lower the prices when they were not asked to do so. Then the present price was a moderate one; and as the rates were high and getting higher, he would have liked the Committee to maintain the present charges until they had paid off all the loans in respect of the gas-works, when the matter might be again considered, and the change more advantageously made. At the same time, he was very averse to voting against the recommendation of the Committee, backed as it was by the knowledge and experience of the Gas Manager himself; and there was the further question as to whether, looking at the cost of production in this instance, they were justified in asking the consumers to keep on paying at the present rate. Taking all things into consideration, he should not vote against the recommendation of the Committee; but he was certainly of opinion that there should be no further reduction until the whole of the loans in respect of the department had been cleared off.

Mr. Austin said he was not one of those who believed that the gas should be supplied to the consumers at the cost of production; but he had always held that when the gas-works were upon a thoroughly solvent and remunerative basis, the consumers should have the illuminant at a fair and just price. Much had been said as to the capital expended on the undertaking—viz., £150,000; but none of the speakers had said anything as to the amount of profit that had been made during the past 19 years. The profit had reached the sum of £130,000 on the expenditure of £150,000, or an average of £6849 per annum, which he thought was not a bad return by any means. Gas was a necessary commodity, and should be placed within the reach of all as far as possible. It was said they had 4500 consumers at present. But, on the other hand, they had more than 5000 non-consumers, who, if they could afford to use gas, would be only too glad to do so; and it was certainly more likely that the number of customers would be increased by reducing the price than by maintaining it at its present figure. He did not think that the attempt to popularize gas by selling it at a price approaching that paid for oil would be a losing transaction, any more than the reduction in the rates for postage, telegrams, and other things had been.

Alderman Lowe, replying on the whole discussion, said he was satisfied with the tone of the debate, and the way matters had gone. He was confident in his mind that the rates of the town would not be increased one farthing by the step they proposed to take, but that the Gas Department would be able to hand over as much (if not more) as they did last year. As to Councillor Thompson's remarks about the return they were paying on their capital, he (the speaker) asserted that, taking into account the repayment of loan and interest and the amount handed over to the town for the relief of the rates, the gas-works were paying, not 4 per cent., but 10 per cent. at the very least; and he was confident that the price of gas would be quite as low as the figure suggested if the undertaking were in the hands of a private company.

The motion was then put, and carried by 17 votes to 8.

BOLTON CORPORATION GAS-WORKS FINANCES.

In the annual abstract of the accounts of the Bolton Corporation, just published by the Borough Treasurer (Mr. G Swainson), some interesting information is given on the finances of the Gas Department. It appears that during the past four years the income has not varied more than £5000; for as the gas-rental has increased, the receipts from residual products have decreased. In 1894, the total income was £133,940; and for last year, it was £135,269—the gas-rental showing an increase from £99,837 to £107,020. The amount voted out of the profits in relief of the rates last year was the largest on record—viz., £24,057, as against £23,478 for the previous twelve months, and £21,432 the year before. Up to then, the profit handed over had not exceeded £18,000. The average cost of coal for the past year was 10s. 2½d. per ton, which is less than it has been since 1890, when it amounted to 9s. 4d. From 84,873 tons of coal carbonized, 881 million cubic feet of gas were obtained, as against 84,898 tons and 871 million cubic feet for the preceding year. The loss by condensation, leakage, &c., went up in the year 1892-93 from 26 to 44 million cubic feet; but it has now dropped to the respectable figure of 34 million feet. The gas annuities have diminished from £14,460 to £5448, which means that three-fifths of these securities have now been redeemed. On the subject of these annuities, Mr. Swainson says that many of the old gas shareholders still hesitate to convert into Corporation stock, although there is a difficulty when one wants to realize the former. Gas annuities, he adds, are not a trust investment; and there is no market for them. This being so, the best and wisest course is for holders to convert them into Corporation stock, which stands several points higher than the annuities, and for which there is a better market.

East Looe Water Supply.—An inquiry was held at East Looe, on Wednesday last, by Colonel Durnford, of the Local Government Board, respecting an application by the Liskeard Rural District Council for power to borrow £3500 for works of water supply for East Looe. Mr. S. W. Jenkin stated that the present supply would not in a dry season admit of more than about five hours' daily service. By the scheme which he had prepared, an excellent spring would be brought in from Wringworthy Moor, about three miles distant. This would yield a supply equal to 30 gallons per head of the population per day. Dr. Nettle, Medical Officer of Health, said that both the existing water supply and the water from Wringworthy had been analyzed, and was found to be of satisfactory quality. Objection was taken by a ratepayer that the District Council had not adopted a joint scheme for East and West Looe which he had prepared.

METROPOLIS WATER SUPPLY.

Extension of the Constant Service.

In his report on the work of the Public Control Department of the London County Council for the past year, the Chief Officer (Mr. A. Spencer) makes the following remarks on the above subject:—

Steady progress in the extension of constant supply has been maintained during the year. Three Companies—the East London, Grand Junction, and Southwark and Vauxhall—now give a constant supply of water to the whole of their London areas. The Kent Water Company hope to complete their London area by September; and the Chelsea and the West Middlesex Companies will probably be finished by April, 1898. The New River Company may also complete their London area by that date; but the Lambeth Company feel unable to give a definite assurance that their area will be dealt with before the end of 1898.

The Chelsea Water Company are now giving constant supply to 85 per cent. of the total number of houses in their area. Three districts have received it during the year: (1) A district bounded by Victoria Street, the River Thames, Page Street, Rochester Row, and Strutton Ground; (2) a district bounded by Vincent Square, Page Street, the River Thames, Vauxhall Bridge Road, Moreton Street, Denbigh Street, Churton Street, and Rochester Row to Vincent Square; (3) a district bounded by Lupus Street, Moreton Street, Vauxhall Bridge Road, the River Thames, and Westmoreland Street. A further district bounded by Commercial Road, Buckingham Palace Road, Belgrave Road, Denbigh Street, Lupus Street, Westmoreland Street, the Thames, and Chelsea Bridge Road, is rapidly approaching completion. The Company will then have three districts remaining on intermittent supply; and these will probably be completed by April, 1898.

Three districts, all situate in the parish of Lewisham, have been dealt with by the Kent Water Company during the year. There remain two districts situate in the parishes of Lee, Eltham, and Charlton; and these will probably be completed by September, when the whole of the Company's London area will be receiving constant supply.

Two districts of the Lambeth Water Company have received constant supply during the year—one situate in the parishes of Lambeth and Streatham, and the other in the parishes of Camberwell and Streatham. The Company have given notice to the Council to deal with two further districts situate in Lewisham; and these are to receive constant supply on Oct. 1, 1897, and April 1, 1898.

Two further districts of the New River Company in Islington, situate to the north of the North London Railway, and embracing the districts around the Cattle Market, Holloway, and Highbury, have received constant supply during the year. A district dealing with the remaining portion of Hackney, and lying between Stoke Newington Road and the eastern boundary of the New River Company's district, has also been dealt with. The Company have also completed another portion of Islington, called the Mildmay Park district, and have received notices to deal with districts in Upper Holloway and Tufnell Park by June and August next respectively. There will then remain to be dealt with the Hornsey Rise and Crouch Hill portions of the Company's London area, the parish of Stoke Newington, and the Hampstead portion of the Company's London area.

Five districts of the West Middlesex Water Company have received constant supply during the year. Two are situate in Paddington, two in Kensington, and one in Hammersmith. Two further districts, situate in Kensington and Hammersmith, will be completed shortly. The Company are dealing with two districts, containing about 1000 houses each every four months, and notices have recently been given for two out of the remaining six districts to receive constant supply by the 1st of August next. At this rate of progress, the Company should complete their London area by April 1, 1898.

The following table shows the position of the constant supply system on March 31 last:—

Name of Company.	Approximate Number of Houses in Company's London District.	Approximate Number of Houses under Constant Supply.	Approximate Number of Houses under Intermittent Supply.	Percentage under Constant Supply.
Chelsea	37,444	32,162	5,282	85·8
East London	103,000	All	None	100·0
Grand Junction	33,408	All	None	100·0
Kent	61,552	58,392	3,160	94·8
Lambeth	73,100	63,149	9,951	86·3
New River	133,000	116,805	16,195	87·8
South. and Vaux.	114,000	All	None	100·0
West Middlesex	61,789	57,147	4,642	92·4

ELECTRIC LIGHTING NOTES.

The Rochdale Town Council have decided to carry out a modest scheme of electric lighting. The recommendation to do so emanated from the Gas Committee, who had been counselled by Mr. E. M. Lacey, a Consulting Electrical Engineer. The estimated cost of the works is £22,000, including the rental of a site now in the possession of the Committee.

The Bexhill Urban District Council have accepted Mr. Preece's scheme for electric lighting, and have resolved to ask the Local Government Board to sanction a loan of £20,000 for carrying out the work. The scheme has met with some opposition, Mr. Young pointing out that at Bedford it cost £32,000 to lay down the plant; and there was a deficit on the first year of £914. There was a loss at Yarmouth of nearly £800 a year, and at Hampstead of £2916; while where the installations had been successful, the majority did not pay more than 4½ per cent., which would not be profitable at Bexhill. Mr. Greed said Mr. Preece had guaranteed that the electric light would pay at Bexhill the first year; but Mr. Young pointed out that this was not a binding guarantee.

In compliance with the request of the City Council, the Electric Lighting Committee of Coventry have reconsidered their proposal to spend £37,900 in extending their works and lighting a number of the streets

with arc lamps. The Council asked for a more moderate scheme; and the Committee have curtailed it by the simple process of chopping off the public lighting, and by agreeing to lay mains only as necessity arises, instead of placing them at once along all the streets mentioned in the original report. The effect of these modifications is to reduce the estimated cost to about £30,000. Whether this will satisfy the Council remains to be seen. At the meeting of that body last month (see *ante*, p. 445), other points were objected to, such as the paying of a heavy commission to a Consulting Engineer, while the Corporation Engineer is capable of preparing the scheme, and also the construction of a railway siding, which convenience has been refused the Gas Committee.

At the meeting of the Warrington Town Council last Tuesday, the Mayor said that in January a resolution approving of the application by the Corporation for a Provisional Order empowering them to supply electricity was unanimously passed; and he had now formally to move—"That an application be made to the Board of Trade for a Provisional Order empowering the Town Council to supply electricity for public and private purposes within the area of the borough; and that the Town Clerk be authorized to take all necessary proceedings for obtaining the said Order." Councillor Green thought the Committee appointed to consider the matter might have given some information on the subject. In some towns electric lighting had been a decided success and a source of profit; but he was rather of the opinion that Warrington was in a different position. The Mayor pointed out that the resolution was simply a formal one; and that information would be given later. The motion was passed unanimously.

The St. Pancras Electricity and Public Lighting Committee have got into a pretty financial tangle. They borrowed £8000 from the London County Council, on the security of the lighting rate, "for the purposes of an electric light station;" but they have spent half this sum on account of the not-too-successful dust destructor. As this is obviously illegal, the Finance Committee have ordered the repayment of this amount to the electric lighting account. To this the Vestry on Wednesday agreed; and they also decided that application should be made to the County Council for a further loan on behalf of the dust destructor, and also that the Council's permission be requested for applying the £4000 repaid to the electricity account for purposes other than the purchase of site. Should this be granted, the Committee suggest that the money "might be applied to reduce the amount of the loan of £10,000 which the Vestry, on July 10 last, decided to apply for." An instructive object-lesson as to the wholesale expenditure of this department is the Vestry's approval of the proposed extension of the main to one house in a certain square. The estimated cost is to be "about £60." The result of such transactions is seen in the Vestry's financial statement to the 28th of August. This document shows the balances of the Regent's Park and King's Road stations to be respectively *overdrawn* by £16,985 and £22,878. Supporters of municipal electric lighting might advantageously study these figures.

The Gloucester Town Council have resolved to ask the Local Government Board to sanction the borrowing of £50,000 for the construction of electricity works, in combination with a dust destructor. They have determined to take this step on a report by Mr. Robert Hammond, which report is almost bewildering in its fullness. Mr. Hammond is skilled in the drafting of such documents, and well knows how to gild obscure points. For instance, early in this particular report, he treats the Corporation to an essay on whether electricity can compete with gas costing 2s. 6d. per 1000 cubic feet. He speaks—as he and others of his profession have so often done before—of the convenience of the electric light; of its being healthy; and of the saving to be effected in cleaning and re-decorating. But he does not give a single example of the actual experience of a consumer, and the saving in hard cash which that consumer has realized by changing from gas to electricity. That is what a person who looks at the matter in a business-like way would desire to know; but Mr. Hammond has carefully refrained from committing himself to figures. The bulk of the report consists of estimates of the cost of different systems and types of plant; and Mr. Hammond gives the Corporation the choice of alternative schemes. In the concluding part of the report, he deals fairly with the subject of the combination of a refuse destructor plant with electricity works. It is unnecessary to follow him through his estimates and arguments, as they are wrapped up in the decision of the Council to seek power to borrow £50,000.

At the meeting of the Salford Borough Council last Wednesday, Mr. Howarth moved that the Council should apply to the Local Government Board for authority to borrow £10,000 for providing a battery sub-station for the Regent Road district, and the requisite cables for the purpose of carrying out these additions to the electric light supply. He explained that the system they had adopted might be improved by the addition of storage facilities for their power, and that the advantages they could then offer to consumers would in all probability bring their receipts much nearer the total of their outlay than had hitherto been the case. The Committee would take care that the sum asked for was spent with care. The motion was adopted. A further proposal to borrow £80,000, to cover the cost of land, buildings, and machinery to extend the electric light undertaking, was on the *agenda*. Mr. Howarth said the Electric Light Committee did not actually propose to lay out this amount; but they wanted to obtain the sanction of the Local Government Board in order that, if the Council afterwards thought fit, a scheme might be carried out. Their electric light undertaking was at last making good headway, and they would, at the beginning of the present winter, supply something like 28,500 8-candle lamps. They would also furnish a good quantity of power from their works. The Mayor (Sir R. Mottram) pointed out that it would be necessary to provide the full details of the scheme before approaching the Local Government Board, who would not sanction an expenditure on a vague undertaking. After some discussion, this view was adopted; and the question was postponed.

The Gas, Water, and Electricity Committee's minutes, presented at the last monthly meeting of the Wallasey District Council, contained a resolution that the sum of £15,000 be borrowed to lay down extra electric plant for the supply of 75,000 units per annum for not less than three years at 3½d. per unit to the New Brighton Tower Company, the supply to be given by March 31 next. Mr. Ellery, the Chairman of the Committee, said they had now a greater demand for electricity than they could meet; and extension of some kind would, therefore, shortly be necessary to meet the ordinary demand. It was proposed to spend the £15,000 sooner than was expected in order to meet the requirements of the Tower Company, who had guaranteed them a profit of £250 per annum. Mr. Ellery laid stress upon the fact that the electricity would be used in the daytime, which was a great desideratum; and in conclusion, he said it had been previously estimated that the Committee would end the year with a loss of a farthing in the pound; but he was glad to be able to announce that, instead of a loss, they would have a small profit. A lengthy discussion followed; and an amendment was proposed that the recommendation to spend the £15,000 be referred back, and that an expert be appointed to report on the question of lighting the whole district. The amendment was lost. Other amendments were discussed; the result being that a condition was made that in supplying the Company, the current should be sent into accumulators of the Company, which must be of sufficient capacity to receive the supply arranged. The recommendation was then approved.

A special meeting of the Rotherham Town Council was held last Wednesday, "to consider the advisability of applying to the Board of Trade for a Provisional Order empowering the Council to supply electricity for lighting and other purposes within the district, and to pass such resolutions in connection therewith as may be thought advisable." The Mayor (Ald. G. Neill, J.P.) moved that application should be made for a Provisional Order as suggested. He remarked that the Council would remember that some time ago they decided to apply for an Order, and that it was necessary to pass the resolution submitted. He supposed the electric light was looked upon as the illuminant of the future; and they in Rotherham did not wish to be behind, but to keep pace with the times. They therefore considered it wise and necessary to take these steps, which he believed would be generally approved by the burgesses. Mr. G. Gummer seconded the motion as Chairman of the Electric Lighting Committee. He remarked the Gas Department of the Corporation did not look upon the electric light as a competitor, and thought there was nothing antagonistic between the two lights. In nearly every instance, from records they had received from various towns, they found that wherever the electric light had been installed the consumption of gas had increased. He mentioned that at the last meeting of the Electric Lighting Committee steps had been taken to engage Professor Kennedy to furnish a report as to what was necessary, and the probable cost of a proper installation. The resolution was agreed to.

The Liverpool Electrical Engineer (Mr. A. B. Holmes) has prepared for the Lighting Committee of the City Council a report dealing with extensions of generating stations and plant which he considers necessary to meet the demands during next year. He points out that the Corporation now supply electricity for 63,000 16-candle power lamps. In addition, the favourable rates offered by the Committee for power purposes are developing a demand for hoists and for motors for use in printing and other trades; and experience in other places indicates that a very material increase may be anticipated in this branch of the business. The area of supply comprised in the Liverpool Electric Lighting Order of 1896 includes the whole of the extended city, a district about 7½ miles long and 5 miles wide. It is not unreasonable to assume, he says, that this area may ultimately require the equivalent of 250,000 to 300,000 16-candle power incandescent lamps, or 25,000-horse power for lighting, and 5000-horse power for motors and other purposes. In addition to this, the tramways may ultimately require at least 10,000-horse power. For this purpose, he assumes that the power required at a not very distant period for the generation of electrical energy may be estimated at 40,000-horse power. Two of the present stations are very favourably located for the supply of energy for lighting in the most important portion of the city, and when completed they will be capable of supplying about 10,000-horse power for this purpose, with due regard to economy of working. The other two stations will ultimately be used as distributing centres only. In conclusion, Mr. Holmes considers that the future demand for electrical energy should be provided for in the following way: 1. Sites should be secured for two generating stations, each with sufficient space to contain plant of 15,000-horse power, and designed for construction in sections as the demand for electrical energy increases. 2. The system of generation and distribution should be direct current not exceeding 550 volts pressure, except for the outlying districts. 3. The engines should be compound or triple-expansion, with condensing apparatus, each capable of developing 1000-horse power at the most economical load.

Two important recommendations by the Electric Lighting Committee claimed the attention of the Salford Town Council at their last meeting. One was a proposal to borrow £10,000 for providing a battery sub-station for the Regent Road district and the requisite cables. The expenditure of this sum, it is predicted, will have a wonderful effect. Mr. Haworth, who moved the adoption of the recommendation, assured the members that the sub-station will enable the Committee, on a very low estimate, to make a profit of more than £1000 a year on the capital invested. Mr. Boys, with charming confidence, asserted that, if the Council carried out the recommendation, they will wipe out the debt which has been incurred "owing to the taking of the advice of specialists." The yearly loss on the works (according to Mr. Foden) is now £3000; and in the hope that the suggested expenditure will reduce this, the Council assented to the Committee's request. A more serious matter was next introduced. This was a proposal to apply to the Local Government Board for sanction to borrow £80,000 to cover the cost of extending the electric light works. Giving an account of the progress of the undertaking, Mr. Haworth stated that the works were opened for the general supply of current on Aug. 7, 1895; and the number of 8-candle power lamps then applied for was 1445. In March, 1896, the number was 8635; and last month it had reached 18,000. The total number promised for the coming winter was equal to 28,300 8-candle power lamps, and 500-horse power. In addition to this, he said there was the probability of the streets being lighted and the trams being worked by electricity, which would mean an increase of 1000-horse power to the plant. This brought up the total plant to 88,300 8-candle power lamps, or 2950-horse power; while the present plant was only capable of supplying 16,000 8-candle power lamps, or 500-horse power. The discussion of the matter did not proceed far, as the Town Clerk pointed out that no object could be gained by passing the resolution, seeing that the Local Government Board would never sanction the borrowing of £80,000 for a scheme which was not in existence. He suggested the recommendation should be withdrawn till a scheme was devised; and this was agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I had very great pleasure in attending the meeting of the Waverley Association of Gas Managers at Berwick last Thursday. Although, in the abstract, it might be asked what was the necessity for this Association—Scotland being such a small country that the gas managers in it might find themselves sufficiently provided with the means of airing their opinions, or of experiencing the benefits to be derived by association with each other, in one body—it has to be said, in the first place, that this is the pioneer Association of all; and, secondly, that the same remark might, with as much, if not more, propriety, be made regarding the Informal Meeting in the spring. This also is an informal meeting; and there is this to be said of such a form of meeting, that it is certainly a very great advantage to do away with the trammels of rigid ceremony, and to get straight to the process of interchange of ideas—which is the real object of such gatherings—without loss of time. I think experience shows that no meetings of gas managers are successful where the whole of the time at the disposal of the company is taken up with the public meeting; but that those gatherings are looked upon as most beneficial where time is given for a private chat with each other, which is, in the case of many, the only way in which they can communicate their thoughts to their fellows. In the case of the Waverley Association, there is this further to be said—that the members are nearly all managers of works of much the same character and size, and therefore large subjects are unappropriate for discussion by them. But the compensating advantage exists that, on this very account, they can get much nearer to each other than they could if they had more large men among them, and the mutual help afforded is thereby greater. It is in every way appropriate that an association of gentlemen who are not required, in their work, to tackle large problems, should confine their attention when they meet to such subjects as actually require to be dealt with in their ordinary working. The Waverley Association does this effectively; and while it continues to do so, there will be the best of all reasons for its existence. On the present occasion, a proposal which was brought forward at the last half-yearly gathering, by Mr. W. Whyte, of Penicuik, to hold the spring meeting in Edinburgh, was agreed to—for next year only, however. It was not by any means a unanimous finding, for to some of the members it is one of the greatest attractions of the meetings that, when a local manager gets the Associations to visit his works, he not only feels honoured but derives benefit from the advice he receives. This is a plea not to be lightly set aside. It has to be remembered that there are about 25 gas-works in the district which the Association embraces; and if only one works a year is to be visited, it will take a long time to reach them all. As a matter of fact, taking two works a year, it is twelve years since the Association were last in Berwick. The opposite side of the sheet is that, when the meetings are held in out-of-the-way places, very few attend; and the link of association is almost severed. The aim of all societies is to provide the greatest good for the greatest number; and when the *pros* and *cons* of this matter are weighed up, I entirely agree that more good is likely to be got by the body of the members by visiting works of various descriptions, in a large city, than is counterbalanced by the benefit which one member a year would derive by his works being visited in spring by his fellow members. No hard-and-fast rule has been adopted, or indeed can be, as the Association retains to itself the exercise of its discretion as to where the meetings are to be held; and while that is so, experience will, no doubt, guide the members as to whether or not the continuance of the spring meeting in Edinburgh is desirable.

The annual accounts of the Aberdeen Corporation Gas Department were approved by the Town Council on Monday; and the price of gas was reduced, as recommended by the Gas and Electric Lighting Committee, from 3s. 4d. to 3s. 2d. per 1000 cubic feet. My account of the proceedings in the Town Council has, however, unaccountably gone astray; and I must defer my notice of the matter for another week.

An attempt is made to-day, in an Edinburgh newspaper, to make believe that a scandal exists in connection with the management of the affairs of the Edinburgh and Leith Gas Commissioners. The effusion is headed "Bungling at the Gas Commissioners: Selling Gas Below Cost Price." It is asserted that, whereas the net cost of gas is 2s. 6¾d. per 1000 cubic feet, the Commissioners have been supplying it to the Corporation for the public lamps at 2s. 1½d. per 1000 cubic feet. Yesterday, however, at a Committee meeting, it was resolved to raise the price to the Corporation to 2s. 6d. "It is alleged," says the article, "that this undercharging by the Commission has been going on for years; and there will probably be an inquiry into the matter." Well, if what is objected to has been going on for years, the gentleman who has now raised the subject has also been a member of the Commission for years. Why his present zeal? I gave the reason some weeks ago, on my own assumption, for the subject being raised in another quarter; and I now find that I am correct—that it has to do with the election to the Provostship of Edinburgh. I do not know who the "underhands" are working for; but I am aware who they are working against. "This," it was remarked by a councillor in my hearing yesterday, "will be difficult for —— and —— to get over." It is a sad piece of tactics. I have dealt with the propriety—or rather I have pointed out the good reasons there are for the Gas Commissioners dealing with their finances in the way they have done. I do not need to go back upon that. But when a scandal is spoken of, it is a proper time to endeavour to stop the movement. There is no scandal. I cannot conceive that there can be a difference of opinion as to the rectitude of the policy of the Commissioners. They found themselves with a large surplus on hand. What were they to do with it? To have thrown it all into next year's account, might probably have been strictly their duty; but the result would have been a lowering of the price of gas to a very unusual extent, with the certainty that the price would have required to be raised again the year after—a policy which no person with a commercial mind could justify. The Commissioners did the next best thing—and one which was perfectly legal—they held it over; and they are endeavouring to work it off by estimating for a deficit. Ordinary consumers have been getting gas at a fraction of a penny per 1000 cubic feet below the net cost of production; and the Corporations of Edinburgh and Leith have been obtaining it, for public lighting, at about 11d. below cost price, or, taking the cost of production only, excluding charges for

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 573).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	24—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17—18	..	4 3 4
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	106—108	..	4 12 8
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9½—10	..	7 0 0
100,000	Stck.	29 June	5	Do. 5 p. c. Deb. Stk	103—106	..	4 14 4
200,000	5	27 May	6½	Bombay, Limited	6¾—7¼	..	4 9 7
40,000	5	,,	6½	Do. New, £4 paid	5¼—5¾	..	4 10 7
330 000	Stck.	27 Aug.	12	Brentford Consolidated	297—302*	..	3 19 5
240,000	,,	,,	9	Do. New	220—225*	..	4 0 0
50,000	,,	,,	5	Do. 5 p. c. Pref.	115—150*	..	3 6 8
159.375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	135—139	..	2 17 6
220,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	201—206	..	4 2 6
933,500	Stck.	27 Aug.	5	Bristol, 5 p.c. max.	130—135*	..	3 14 1
420,000	20	26 Mar.	11½	British	56—57	..	3 18 11
50,000	10	27 Aug.	11½	Bromley, Ordinary 10 p. c.	23—25*	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18—20*	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10½—11½	..	5 4 4
98,122	Stck.	—	4	Do. 4 p. c. Deb. Stk.	98—100	..	4 0 0
150,000	20	15 July	8¼	Cagliari, Limited	30—32	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16½—17½	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	59—60	+½	5 0 0
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	343—348	..	3 17 6
165,000	,,	,,	10½	Do. New do.	257—262	..	4 0 1
165,000	,,	11 June	4½	Do. 4½ p. c. Deb. do.	155—158	..	2 16 11
800,000	Stck.	11 June	13	Continental Union, Limited.	255—260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	215—220	..	4 10 11
51,600	Stck.	27 Aug.	14	Croydon Com'cial A 10 p. c.	315—320*	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	252—257*	..	4 5 7
535,000	Stck.	12 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	137—140	..	3 15 0
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 July	11	European, Limited	25—26	..	4 4 7
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 11
5,896,590	Stck.	12 Aug.	12¾	Gaslight & Coke, A, Ordinary	317—320	..	3 19 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	113—118	..	3 7 10
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	315—320	..	3 2 6
30 000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225	..	3 6 8
1.300,000	,,	,,	7	Do. H, 7 p. c. max.	203—208	..	3 7 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	315—320	..	3 2 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	180—185	..	3 4 10
1, 161,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	138—141	..	2 16 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	155—158	..	2 16 11
908,000	,,	,,	6	Do. 6 p. c. do.	207—212	..	2 16 7
70,000	10	13 May	6	Hongkong & China, Limited	12½—14½	..	4 2 9
3,800,000	Stck.	13 May	10	Imperial Continental	217—222	..	4 10 2
376,400	100	3 Aug.	4	Do. 4 p. c. Debs. Red.	99—102	..	3 18 5
473,600	Stck.	12 Aug.	3½	Do. 3½ p. c. Deb. Stk ,,	104—107	..	3 5 5
75,000	5	29 June	6	Malta & Mediterranean, Ltd.	5½—6	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112—114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	108—110	..	4 1 10
541,920	20	11 June	5	Monte Video, Limited	15—16	..	6 5 0
150,000	5	27 May	8	Oriental, Limited	8—8½	−¼	4 14 1
135,000	5	,,	8	Do. New, £4 10s. paid	7½—7¾	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	4¾—5¼	..	6 13 4
420,000	100	3 May	6	People's Gas } 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 June	6	of Chicago } 2nd Do.	105—110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14½—15½	..	6 9 0
5,475,000	Stck.	12 Aug.	5½	South Metrop., 4 p.c. Ord.	145—148	..	3 10 11
1,416,667	,,	15 July	3	Do. 3 p.c. Deb. Stk.	105—109	..	2 15 0
60,000	Stck.	12 Mar.	12†	Tottenham & Edmonton, A	275—285	..	4 4 2
60,000	,,	,,	9†	Do. B	190—200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited.	13¾—14¼	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	29 June	10½	Chelsea, Ordinary	335—340	..	3 1 9
150,000	,,	,,	5	Do. 5 p. c. Pref.	177—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	157—160	..	2 16 3
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7½†	East London, Ordinary	225—230	+1½	3 5 2
554,740	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	163—166	..	2 14 3
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106½—107½	..	2 15 10
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	120—125	..	3 0 0
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Aug.	13	Kent	350—355	..	3 13 3
160,000	,,	,,	7	Do. New, 7 p. c. max.	215—220	+5	3 3 7
1,043,800	100	29 June	9¾	Lambeth, 10 p. c. max.	288—293	..	3 6 6
406,200	100	,,	7½	Do. 7½ p. c. max.	223—228	+3	3 5 9
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Aug.	13	New River, New Shares.	442—447	..	2 18 2
1,000,000	Stck.	29 July	4	Do. 4 p. c. Deb. Stk.	151—154	..	2 11 11
902,300	Stck.	29 June	5	S'thwk & V'xhall, Ordinary	160—163	..	3 1 3
126,500	100	,,	5	Do. Do. 7½ p. c. Max.	151—154	..	3 4 11
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	173—178	..	2 16 2
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 June	13	West Middlesex	313—318	..	3 2 10
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—166	..	2 14 3

† Next dividend will be at this rate. *Ex div.

interest and annuities, at about 5d. below cost price. The public have surely not so tender a conscience as to be scandalized by the fact that the Gas Commissioners have, while paying their own way, been giving them so good a bargain. Those who are shocked to think that the Gas Commissioners have been cheating themselves by benefiting the public, should turn their attention to another public body—the Water Trust. The Trust require to charge 5d. or 5½d. (I forget which) per pound upon householders for a supply of water; but they supply water to the Corporations for public purposes at 1d. per pound rental. The practice is universal, yet no one has ventured to say that doing it is scandalous. Had the Editor considered what he was publishing, I scarcely think he would have troubled his readers with such a *canard*. But I am afraid that in much modern journalism eagerness to be first takes the place of reflection—and that recklessness of assertion is looked upon as of little moment, so long as it does not amount to libel.

The Falkirk Gas Commissioners have been able to set aside £1200 for depreciation of works and plant, out of the profits of the past year. In the year previous, they set aside £900. This year they have also made a further reduction in the price of gas—from 3s. 9d. to 3s. 7d. per 1000 cubic feet. Twelve months ago, they reduced it from 4s. 2d.; so that, in the two years of Corporation management of the gas undertaking, they have been able to give a reduction of 7d. per 1000 cubic feet. This is a result which must be extremely gratifying to those who promoted the transfer. But the Commissioners have gone further this year, in agreeing to abolish meter-rents as from the next survey, and to supply consumers with burners free of charge; these two items being equal to a further reduction of 3d. per 1000 cubic feet. At a meeting of the Commissioners this week, the good work which is being done for them by Mr. P. B. Watson, the Manager, was recognized by an addition being made to his salary of £50 a year.

The annual meeting of the St. Andrews Gas Company was held on Wednesday. It was reported that the revenue for the year amounted to £5904, and the expenditure to £4312—leaving a balance at credit of £1592. The Chairman attributed the position of the Company to the care and attention with which their interest had been looked after by their veteran Manager (Mr. J. Hall) and his son Robert, who now assists him. The usual dividend of 50s. per share was paid; and the price of gas was reduced from 3s. 6d. to 3s. 4d. per 1000 cubic feet. The Company, it was reported, had purchased property at the Shore, for extensions at the gas-works, at the price of £2000. The output of gas last year was 32½ million cubic feet. There has been an increase during the past ten years of 10½ million cubic feet.

Following up their consideration of the subject of the extension of the Dundee Corporation Gas-Works, the Gas Committee sent a deputation this week to Glasgow, to see the works there. The deputation visited Glasgow on Thursday, and were shown the Tradeston works, which are about as completely equipped as any gas-works in the United Kingdom. Mr. Foulis personally conducted them over the works.

A Committee of the Corporation of Perth have this week resolved that the cost of an inquiry into the subject of the provision of electricity by the Corporation shall be borne, one half by the Gas Commissioners, and the other half by the Police, Lighting, Fire-Engines, and Cleansing and Sanitary Committees.

The community of Monifieth, near Dundee, have given their opinion, by means of a *plébiscite* on the question of whether or not the Corporation should undertake the providing of a gas supply. On this subject, the burgh is unique in this respect, that there is no existing gas supply, or other means of public lighting, within it. The vote was 210 in favour, and 100 against the erection of gas-works. The Police Commissioners met on Wednesday night, and resolved, in view of the decided nature of the vote, to take steps, after the municipal elections in November, to have the Burghs Gas Supply Act put into force.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 11.

Sulphate of Ammonia.—The market has again been active; and a further advance in values has been scored—the closing quotations being £7 17s. 6d. to £8 per ton, delivered free on board at the ports. Supplies for prompt delivery continue scarce; and, consequently, business in this position has been limited. In the forward position, considerable business has been done; and transactions are reported at £8 per ton for October-March and October-December delivery, f.o.b. East coast. Consumers for the most part hang back, in the hope of a relapse when the season of large production arrives.

Nitrate of Soda has been unmoved by the improvement in sulphate of ammonia; and spot prices remain 7s. 6d. per cwt. for good up to 7s. 7½d. per cwt. for refined quality. There has been a quiet market for cargoes afloat and for shipment; the quotations being 7s. 4½d. to 7s. 7½d. per cwt. according to position, ordinary quality.

LONDON, *Sept.* 11.

Tar Products continue to show a featureless market. Very little new business is being done; and deliveries taking place are almost entirely on old contracts. Production is small; and most makers are easy in regard to stocks. Benzols are quoted lower; and smaller bids are also being made for carbolic acid, though carbolic, for disinfecting purposes, is fairly firm.

Average prices obtaining during the week are: Tar, 16s. 6d. to 20s. Pitch, 17s. to 20s. Benzol, 90's, 1s. 9½d.; 50's, 2s. Toluol, 2s. 2½d. Solvent naphtha, 1s. 6½d. Crude, 30 per cent., naphtha, 10½d. Creosote, 1½d.; liquid, 2d. Heavy oils, 40s. Carbolic acid, 60's, 1s. 9½d. Naphthalene, nominal, 40s.; salts, 20s. Anthracene, "A," 5d. to 6d.; "B," 4d. to 5d.

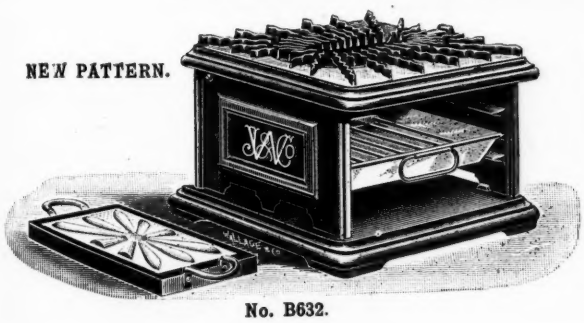
Sulphate of Ammonia is in much better request; and a large business is reported at prices ranging between £7 16s. 3d. and £8, less 3½ per cent. Makers are firm in their ideas; while buyers seem to have made up their minds that a little more money will have to be paid to secure forward business.

Nitrate of Soda, whether in sympathy or not, is dearer, with an advancing tendency.

WRIGHT'S RAPID GAS-GRILLERS

Suitable for use with PREPAYMENT METERS.

NEW PATTERN.



No. B632.

No.	Outside Dimensions.			Price complete with Pan and Grid and Special Deflector.
	Width.	Depth.	Height.	
B632	11	11	7½	12s. 0d.

This Griller is very strong; and there are no working parts to get out of repair. **Admirably adapted for letting out on hire.**

No. B628.

No.	Outside Dimensions.			Price complete with Pan and Grid.
	Width.	Depth.	Height.	
B628	12	8½	6½	6s. 6d.
B629	12	8½	6½	6s. 6d.

This Broiler is made entirely of **Cast Iron**, and is fitted with a very powerful Burner. Will cook two Chops, and boil a Kettle at the same time.

JOHN WRIGHT & CO., LTD., BIRMINGHAM and LONDON.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Steadily increasing activity in the better qualities of round coal is now the general report throughout this district; and many of the collieries have been put on to five days. Prices are stiffening up where they have previously been cut low; but it is very exceptional where there has been any actually quoted advance on what may be termed current rates. There is, however, very little of the best Wigan Arley now to be bought under 10s. to 10s. 3d. per ton at the pit; with Pemberton four-feet and seconds Arley averaging 8s. 6d.; and common house coals, about 7s. Steam and forge qualities are about as last reported. The requirements for works purposes are restricted by the engineering dispute; but, on the other hand, there is an increased demand on common coal for the lower house-fire qualities, and supplies are moving off moderately at recent quotations—averaging 6s. to 6s. 3d. per ton at the pit. Shipping is also fairly good, with 7s. 6d. up to 8s. per ton being obtained for steam coal, according to quality, at the ports on the Mersey. Supplies of engine fuel are generally ample for requirements; but they are in no way excessive; and prices are maintained without difficulty at late rates.

Northern Coal Trade.—The autumn is now changing the course of the coal trade in the North-east, by enlarging the inquiry for gas coal and lessening that for steam coal, and thus having a different effect on the prices of the two kinds. For best Northumbrian steam coals, the demand is slightly less; and to continue fully at work, some of the collieries have accepted lower prices for orders. The quotation is now 8s. 6d. per ton f.o.b. for best steam coals; 8s. for second class; and from 3s. 6d. to 3s. 9d. for steam smalls. In the gas coal trade, some of the local contracts are being allotted, and that at prices from 4½d. to 6d. per ton above those for the contracts that are now running out. The cost of production of coals is increasing; and coalowners have to recoup themselves for this. For occasional cargoes of gas coals, the price quoted varies from 7s. 6d. to 8s. per ton f.o.b.; but at least one of the largest producers in the north has a higher quotation. The production of gas coke is increasing; but the price shows no alteration this week, and the output is well taken up.

Scotch Coal Trade.—There is continued activity, though, owing to the restrictive policy of the miners, the volume of trade is not quite so large. All classes of coal are finding a ready outlet. The prices quoted are: Main, 7s. per ton f.o.b. Glasgow; ell, 7s. 3d. to 7s. 6d.; and splint, 7s. 6d. The shipments for the week amounted to 171,449 tons—a decrease when compared with the preceding week of 25,315 tons, but an increase over the corresponding week of last year of 7082 tons. For the year to date, the total shipments have been 5,380,268 tons—an increase over the same period of last year of 209,188 tons.

East London Water Company.—The Directors of this Company recommend a dividend for the half year ended Midsummer last at the rate of 7½ per cent. per annum, less income-tax, leaving an unappropriated balance of £8375 to be carried forward.

Ottoman Gas Company, Limited.—Reporting upon the financial results of the working during the half year ending June 30, the Directors of this Company state that the gas-rental amounted to £8599, as against £8630 in the corresponding period of 1896; and the net profit was £2833. The amount standing at the credit of the profit and loss account is £3495; and the Directors recommend the payment of a dividend at the rate of 7 per cent. per annum on both classes of shares. This will absorb £2625, and leave £870 to be carried forward.

The Keswick District Council and the Gas-Works.—Communications have passed between the Keswick District Council and the Gas Company regarding the proposed purchase of the works by the former. At last week's meeting of the Council, a letter was read from the Directors of the Company stating that they were not at present prepared to incur the expense necessary for preliminary investigations; but they would consider an offer from the Council. Some information as to the Company's financial position appeared under the heading of "Provincial Gas Companies" in the "Journal" for Aug. 31.

The Eccup Reservoir of the Leeds Corporation.—After many disappointments and a large expenditure of time and money, there now appears to be a prospect that water may once more be allowed to flow into the Eccup reservoir of the Leeds Corporation. Mr. T. Hewson, the Water Engineer, has reported to his Committee that he is preparing to rearrange the inlet-mains from the Washburn Valley with the object of running water into the reservoir. He also stated that the Consulting Engineer (Mr. G. H. Hill) had visited Eccup, along with himself, to inspect the embankment; and after further information has been furnished to him, he will report on the subject.

The Ambleside Arbitration Award.—Mr. Christopher Oakley, the Umpire appointed in the arbitration recently held to determine the purchase price of the Ambleside Gas and Water Company's works, has just issued his award. He gives £17,080 as the price of the gas-works, and £11,281 for the water-works—a total of £28,361, compared with the £24,000 at which Mr. Hepworth in the first instance recommended the Board to buy. There are outstanding mortgages of £2000, so that the sum to be provided will be £26,361, *plus* £1350 for undivided profits to Midsummer, and a retiring allowance for the Company's Secretary and Manager (Mr. T. Mackereth), who has been 30 years in their employ.

Nottingham Corporation Gas Supply.—The accounts of the Gas Department were presented at yesterday's meeting of the Town Council. We shall next week have more particulars to publish; but meanwhile it may be stated that, during the twelve months to March last, the expenditure on capital account was £9691, less £500, the usual depreciation on gas-stoves, in addition to which £1100 has been paid to reduce the loan. To meet this outlay a new loan of £8000 has been raised, which, with the balance in hand at March, 1896, £5903, left a balance at March last of £4712. The income on revenue account amounted to £244,920; being an increase of £6784. The expenditure on revenue account was £168,269; being an increase of £2908. The increase in profit consequently was £3876. There was an increase of £6784 in the receipts on revenue account over the previous year; the total income being £244,920.

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Additional Gas Capital Powers Wanted for Halifax.—At last Wednesday's meeting of the Halifax Town Council, the Gas-Works Committee recommended that powers be obtained in the next Bill promoted by the Corporation to increase the borrowing powers for gas-works purposes by the sum of £250,000. Alderman Woodhead, the Chairman of the Committee, said it was calculated that £250,000 would last 15 years. Large extensions were in progress; and within the next three years £100,000 would be required for gas-works purposes, of which sum £40,000 would be needed for a new holder. The Gas Committee also proposed to lay down water-gas plant at an estimated cost of £10,000. In the year 1882 there were 320 million cubic feet of gas sold; and in the year to March last, the quantity sold was 684 million cubic feet. The amount of capital employed per million cubic feet in the year 1882 was £724; and for the last year it was only £467. It was ultimately resolved that application be made to increase the borrowing powers for gas-works purposes by £150,000, so as to cover ten years' requirements for extensions.

The Farnworth Gas Company and the Local Authorities.—A proposal has been made that the Local Authorities whose districts are at present served by the Farnworth and Kearsley Gas Company, should purchase the undertaking, and administer it on the lines adopted by the Accrington Gas Board. The question will be discussed at the next meeting of the Kearsley District Council, on a notice of motion by Mr. Shippobottom. At the last meeting, this gentleman spoke rather strongly on the point, and urged that the present was an opportune time for the District Councils of Farnworth, Little Hulton, and Kearsley joining together for the purpose of acquiring the works. With reference to the agitation as to the price of gas, at the last meeting of the Little Hulton District Council, a communication was read from the Company to the effect that, as soon as circumstances would allow, a reduction would be made in the charge; the Secretary at the same time reminding the Council that it was only in September last that a reduction was made in the district. A deputation was appointed to wait on the Company, with representatives from neighbouring townships, with the view of securing a further concession.

Carlisle Corporation Gas-Works.—In the last issue of the "JOURNAL," we gave some particulars as to the financial results of the working of the Carlisle Corporation Gas and Water Departments during the year ending June 30; and we are able this week to supplement the figures then given by a few others of an interesting character. During the year, 26,181 tons of coal and cannel were carbonized, producing 275,539,000 cubic feet of gas, an increase of 5·8 per cent. on the previous year, when the quantity made was 260,423,000 cubic feet. The yield per ton of coal was 10,525 cubic feet. Of the 26,181 tons of coal used, 7518 tons were cannel, and the remainder common coal. Of the 275,539,000 cubic feet of gas made, 260,233,300 feet were sold, 3,942,700 feet used on the works, and 11,363,000 feet unaccounted for. The average illuminating power was 17·10 candles. The estimated quantities of residuals were: Coke, 13,090 tons; tar, 1826 tons; and sulphate of ammonia, 286 tons. The number of consumers, based on the accounts, is now: By ordinary meters, 6464; by "penny in the slot" meters, 1986—making a total of 8450. The continued increase in the consumption of gas will, the Engineer (Mr. C. B. Newton) says, render it necessary to extend the works and plant at an early date by building on the site already reserved for gas-works purposes at Boustead's Grassing.

The Northampton Gas Company and the Laying of Electric Light Culverts.—An interesting dispute has arisen between the Northampton Electric Light Company and the Gas Company as to the laying of the electric culverts; and, an amicable arrangement being found impossible, recourse has been had to arbitration. The Electric Light Company sought power to depress the gas service-pipes where necessary, so that their own culverts might be placed as near the surface as possible. This was resisted by the Gas Company, on the ground, principally, that the scheme was impracticable unless the gas-mains were also lowered; and this the Electric Light Company did not propose to do. Major-General Scott was the Arbitrator appointed by the Board of Trade; and last Tuesday he sat at the Town Hall, to hear the arguments and evidence on each side. Mr. E. M. Browne appeared for the Electric Light Company, and stated that it was proposed to place the culverts about 12 or 16 inches below the surface of the pavement. The gas service-pipes were generally found at a depth of 14 or 15 inches; so it was evident that, speaking generally, some alteration was required to enable the Electric Light Company to lay their culverts in the positions they deemed expedient. They therefore asked that all gas service-pipes might be, if necessary, uniformly depressed, so as to admit of the culvert being placed over them. Several witnesses were called in support of the case. They expressed the opinion that it was desirable for many reasons that the culverts should be shallow; that it was not unreasonable to ask power to depress the gas service-pipes; and that permission was generally readily acceded by gas companies. The Engineer to the Company also declared that it was only proposed to alter those pipes that could be lowered without detriment to the Gas Company. For the latter Dr. Faulkner contended that the proposals of the Electric Light Company were absolutely impracticable without lowering the gas-mains; and they did not ask to do that. In fact, he did not suppose they would seek such power, because it would involve them in an immense expenditure, so that they would prefer to lower the culverts. Mr. John Eunson, the Engineer to the Gas Company, also spoke to the impracticability of the proposals. The decision of the Arbitrator will be awaited with interest.

It is stated that, by the use of the Anti-Vibration Incandescent Lighting Company's device in connection with 850 Bray lamps fitted with incandescent burners in the streets of Bradford, compared with the cost of the incandescent light without the anti-vibration fittings, the Corporation save over £600 a year.

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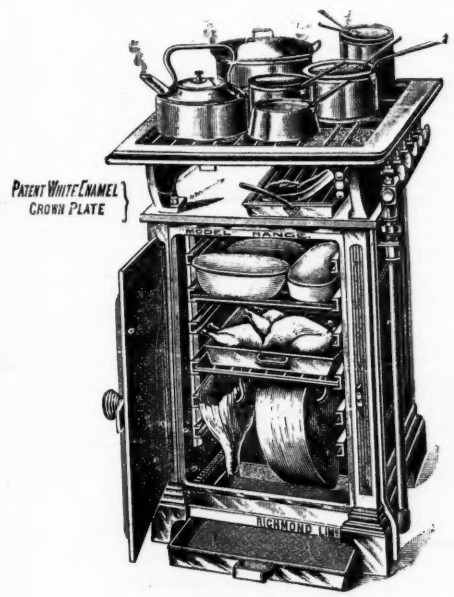

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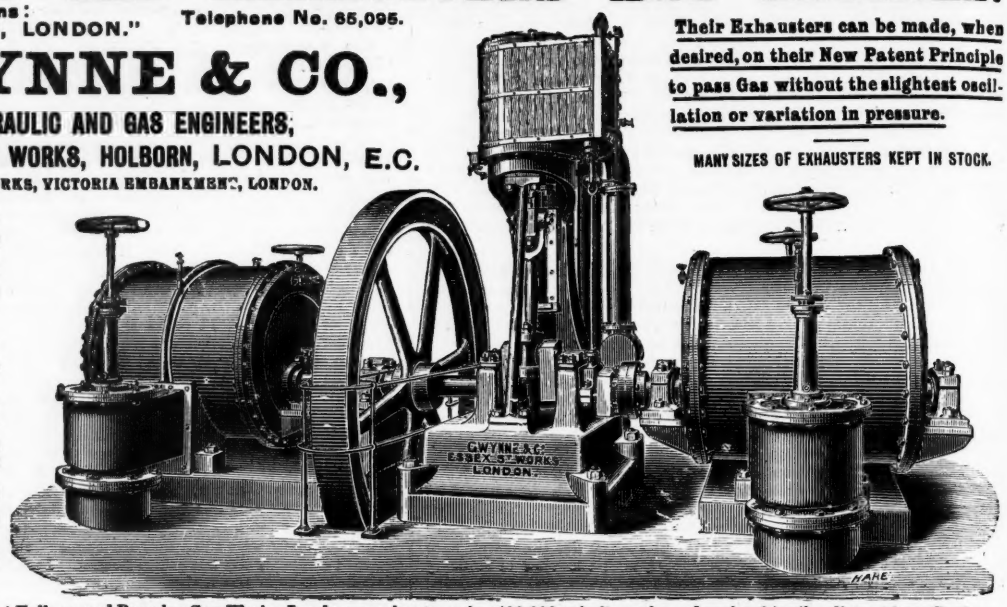

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FOR SALE—A Parcel of Shares in the PORTSEA ISLAND GASLIGHT COMPANY, paying Dividends of 12 and 13 per cent. The Company is on the Sliding-Scale, with a Reserve Fund equal to one-quarter of its Capital.
Also Shares in the DORKING GAS COMPANY, HAVANT GAS COMPANY, and SOUTHAMPTON GAS COMPANY.
50 £10, 1857, Original Issue Shares in the BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY, paying the full Statutory Dividends of 10 per cent.
Further Particulars on application to LOVE AND COOPER, Stock Brokers, Osborne Road, SOUTHSEA.

RETORTS AND FIRE-BRICKS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of about 1500 feet run of FIRE-CLAY RETORTS, 50,000 FIRE-BRICKS, and 70 tons of CLAY.
Specification and Form of Tender may be obtained from the undersigned, to whom Tenders, endorsed "Retorts, &c.," must be delivered on or before Noon of Thursday, the 23rd of September, 1897.
J. M. VEEVERS,
Engineer and Secretary.
Gas Offices, Rochester,
Sept. 9, 1897.

RAMSGATE CORPORATION.

TENDERS FOR GASHOLDER.

THE Gas and Water Committee are desirous of receiving TENDERS for a Three-Lift GASHOLDER; outside lift, 115 feet diameter.
Tenders to be sent in, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, not later than Ten a.m. on Monday, the 11th of October.
Full Particulars will be given on application being made, enclosing cheque for £3 3s., which will be returned on receipt of a *bonâ-fide* tender, to
WILLIAM A. M'INTOSH VALON,
Engineer.

NEWPORT (MON.) GAS COMPANY.

HYDRAULIC MAIN AND RETORT-FITTINGS FOR SALE.

THE Directors of the above Company invite TENDERS for Six lengths of CAST-IRON ⊃ HYDRAULIC MAIN, with Standards, Ascension-Pipes, Dip-Pipes, Buck-Staves, and Tie-Rods to correspond.
Full Particulars can be obtained from the Engineer.
Tenders to be sent in addressed to the Chairman of the Newport (Mon.) Gas Company on or before Wednesday, the 6th day of October, 1897, endorsed "Retort-Fittings."
The Directors do not bind themselves to accept the highest or any tender.
By order,
EDWARD F. MARFLEET,
Secretary.

THE Corporation of Middleton are pre-pared to receive TENDERS for an Installation of INCLINED RETORTS and REGENERATOR FURNACES, at their Gas-Works.
A general Specification and further Particulars may be obtained from Mr. T. Duxbury, Gas Manager.
Tenders, accompanied by the Contractor's own Designs and Specifications, are to be addressed to the Chairman of the Gas Committee, endorsed "Inclined Retorts," and delivered at my Office on or before Wednesday, the 15th of September, 1897.
The Corporation do not bind themselves to accept the lowest or any tender.
FREDERICK ENTWISTLE,
Town Clerk.
Town Hall, Middleton,
near Manchester, Sept. 1, 1897.

THE Nelson Corporation invite Tenders for the removal of the surplus TAR produced at their Nelson and Brierfield Works, for One Year only.
Quantity produced and further Particulars may be obtained from the Manager, Mr. William Foster.
Tenders, marked "Tender for Tar," must be sent to the undersigned on or before the 21th day of September, 1897.
R. M. PRESCOTT,
Town Clerk.
Town Hall, Nelson,
Sept. 9, 1897.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 7th of October, 1897, at Twelve o'clock at Noon, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 30th of June, 1897, and to declare a Dividend.
The STOCK TRANSFER BOOKS WILL BE CLOSED from the 23rd of September inst. to the 7th of October next, both days inclusive.
By order of the Board,
H. D. ELLIS,
Secretary.
Offices: Stepney,
Sept. 10, 1897.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ASSEMBLY of Proprietors will be held at the Company's Offices, St. Helen's Place, Bishopsgate Street, E.C., on Thursday, the 7th of October, 1897, at Twelve o'clock noon precisely, pursuant to Act of Parliament.
The TRANSFER BOOKS in respect of the ORDINARY STOCK WILL BE CLOSED on the 22nd of September inst., and RE-OPENED on the 14th of October, on which day the Dividends on this Stock will be payable.
By order,
I. A. CROOKENDEN,
Secretary.
St. Helen's Place,
Sept. 9, 1897.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 29th inst., at Half-past Twelve o'clock precisely, to transact the usual Business, to declare a Dividend for the Half Year ended the 30th of June last, and to elect two Directors and one Auditor in place of those who go out by rotation, but who are eligible to be re-elected.
Notice is Hereby also Given, that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 18th inst., and RE-OPENED on the 30th inst.
By order of the Court of Directors,
H. B. CHAMBERLAIN,
Secretary.
Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
Sept. 8, 1897.

OTTOMAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held at 9, Queen Street Place, Cannon Street, E.C., on Tuesday, Sept. 21, 1897, at Half-past One o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended June 30 last, to declare a Dividend, and for General Purposes.
The TRANSFER BOOKS WILL BE CLOSED from Sept. 14 to 21, both days inclusive.
By order of the Board,
THOMAS GUYATT,
Secretary.
9, Queen Street Place, Cannon Street,
London, E.C., Sept. 7, 1897.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £43,333 6s. 8d. THREE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE, £105 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £43,333 6s. 8d. of THREE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Acts, 1882 and 1896.
Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and tenders must be sent in on or before Tuesday, the 14th day of September, 1897.
The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £105 money for each £100 Debenture Stock.
By order,
FRANK BUSH,
Secretary.
Offices: 709a, Old Kent Road, S.E.,
Aug. 18, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

Now Ready, Price 10s. 6d.

WARNER'S DIAGRAMS

OF THE ANNUAL

AVERAGES OF PARLIAMENTARY RETURNS

RELATING TO GAS UNDERTAKINGS,

1887 TO 1895.

Together with the Private and Public Undertakings Grouped—1895 and 1896 Workings.

COMPILED BY

W. J. WARNER, of South Shields.

These Diagrams, which were noticed in the "JOURNAL" for Aug. 24, 1897, may be had of

WALTER KING, 11, Bolt Court, FLEET ST., E.C.

Telephone: Castleford No. 214. | Postal Address: Castleford.
Telegrams: "Silkstone Castleford."

THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.

ALLERTON BYWATER, CASTLEFORD.

Steam, Manufacturing, & Gas Coals & Cannel

Analysis, Contracts, Trial Waggons, and Quotations for Large and Small Orders. Inquiries Solicited.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,

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E. ASQUITH & CO.,

Hydraulic Engineers,

17, Mather Street, Ancoats, Manchester,

Fit up Plants for

Pressing Anthracene, Naphthalene, &c.

Competent Men sent out to erect same. Estimates given.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

8 Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13¾ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

AT LAST!!!

Fourfold Increase of Light

BY USING

FREDUREAU'S Patent LIGHT-DIFFUSING GLOBES

Ask for Report by Professor Silvanus Thompson, D.Sc., F.R.S.

Improvements for 1897-8 Season.

ALL PATTERNS OF BEST ENGLISH MANUFACTURE.

WEIGHT REDUCED BY OVER 50 PER CENT.

NO SPECIAL GALLERY RINGS REQUIRED
(WITH ONE EXCEPTION).

NEW AND ARTISTIC DESIGNS.

"CENTAUR."

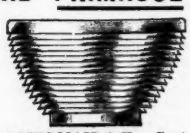
"SPHINX."

ALL PATTERNS NOW MADE IN OUR PATENT ROSE AND PRIMROSE TINTS.

MOULD MARKS PRACTICALLY INVISIBLE.

PRICES MATERIALLY REDUCED.

LIBERAL TERMS TO THE TRADE.



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FOR STREETS, SHOPS, BANKS, OFFICES, AND WAREHOUSES.

Prices from 15s. per Dozen.

Call at Show-Rooms to Inspect, or write for Samples and Terms to the Patentees and Manufacturers,

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TROTTER, HAINES, & CORBETT,

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FIRE-CLAY & BRICK WORKS,

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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JAMES OAKES & Co.,

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AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

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THE STAFFORDSHIRE TUBE Co.

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ROBERT MARSHALL,

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Prices and Analysis of all the Scotch Cannels on Application.

THOMAS TURTON

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MANUFACTURERS OF

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FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

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THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton .	10,500	Cub. Ft.
Illuminating Power . .	16·9	Candles.
Coke (of good quality) .	67·5	per Cent.
Sulphur	0·58	,,
Ash	2·73	,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., LD.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THE SILICA FIRE-BRICK

COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

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E. FOSTER & CO.,

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Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES; BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

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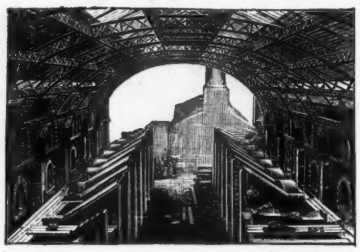

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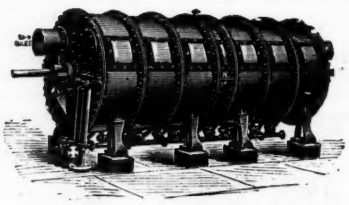
Improved
PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

MALLEABLE
and all Kinds of
CASTINGS.



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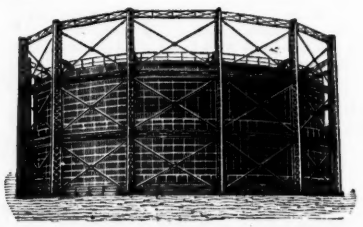
ROOFS, BRIDGES, TANKS, GIRDERS.



Improved
BYE-PASS and
CENTRE-VALVES,
GOVERNORS,
and METERS.

Rotary or Pump
EXHAUSTERS.

80, CANNON STREET, LONDON,
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WHITESTONE IRON WORKS, HUDDERSFIELD.

THE "TRAFALGAR"
PREPAYMENT GAS-METER
FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
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4. Unaffected by irregularities in shape or thickness of the penny.
5. Can be fixed to any ordinary Wet or Dry Meter.
6. Extra large Money-Box.
7. Price Changer can be altered without otherwise disturbing the Meter.
8. Index showing number of pennies in the mechanism at any time.
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GUARANTEED FOR FIVE YEARS.

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PENNY-IN-THE-SLOT GAS-METERS,
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Every Description of ORDINARY GAS-METERS.

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MANUFACTURERS
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GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
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FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**
WHITE GLAZED AND SALT GLAZED BRICKS, BUFF FACING BRICKS, &c.
For Prices and Analysis, apply as above.

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HUTCHINSON BROTHERS,
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MANUFACTURERS OF IMPROVED
WET AND DRY GAS-METERS.
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The "Falcon" Lamplighter's Torch. Service Cleaners.
SYPHON AND OTHER PUMPS.
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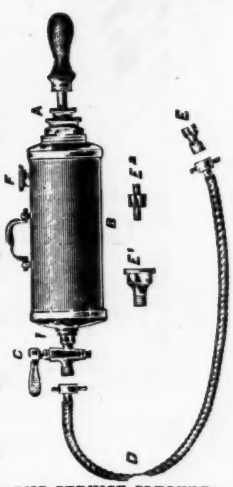

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S. CUTLER AND SONS, MILLWALL, LONDON.

CARBURETTED WATER-GAS PLANT.

(CUTLER'S PATENTS)

ADOPTED AT HORNSEY, HASTINGS, SOUTHEND,

PLYMOUTH, BUENOS AYRES, SOUTHALL (BRENTFORD GAS COMPANY).

GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

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BRANDS: CLIFFS', INGHAMS', BROOKES'.

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WORTLEY, LEEDS.

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CONTRACTORS for BUILDINGS, ROOFS, RETORT SETTINGS & IRONWORK COAL AND COKE BREAKING, ELEVATING, CONVEYING, AND STORAGE PLANT. RE-SETTING EXISTING RETORTS. RETORT HOUSE WORK GENERALLY

MANUFACTURERS of HORIZONTAL & INCLINED MACHINE AND HAND-MADE RETORTS, BRICKS, BLOCKS, TILES, &c.

NEW INCANDESCENT SUNLIGHT BURNER AND MANTLE.

Gas Managers, Fitters, and the Trade are invited to apply for

New Price List, ready Sept. 1st.

POPULAR PRICES.

NEW PATENT BURNER with Non-Corroding Top.

THE SUNLIGHT MANTLE,

Decided by the High Court not to infringe other Patents, Gives an Illuminating Power Four times that of ordinary Gas-Burners, and lasts from **4** to **6** Months in ordinary use.

See the marvellous EFFECT produced upon Colours, Pictures, Carpets, Complexions, &c.

Everything seen in its true Natural Colour. Once used, always appreciated.

Being the STRONGEST MANTLE, it will last longer than others, and thus is by far the CHEAPEST MANTLE in the Trade.

Head Office and Show Rooms: **33 & 34, SHOE LANE, E.C.** (ONE MINUTE FROM HOLBORN CIRCUS)

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NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING CO.,

— *LIMITED.* —

J. H. SHELDRAKE, General Manager.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1826.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-Candle Power
PLAIN IRON LAMP,
CLASS A— **55/-**
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.

HENRY GREENE & SONS,
153 & 155, CANNON STREET,
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PARTICULARS AND PRICES FREE. AGENTS WANTED.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
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[See Illustrated Advertisement, Sept. 7, p. 555.]

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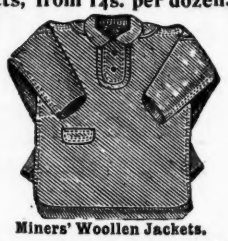
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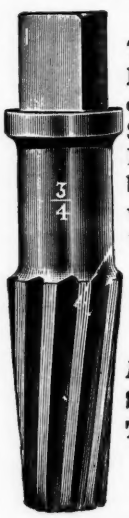

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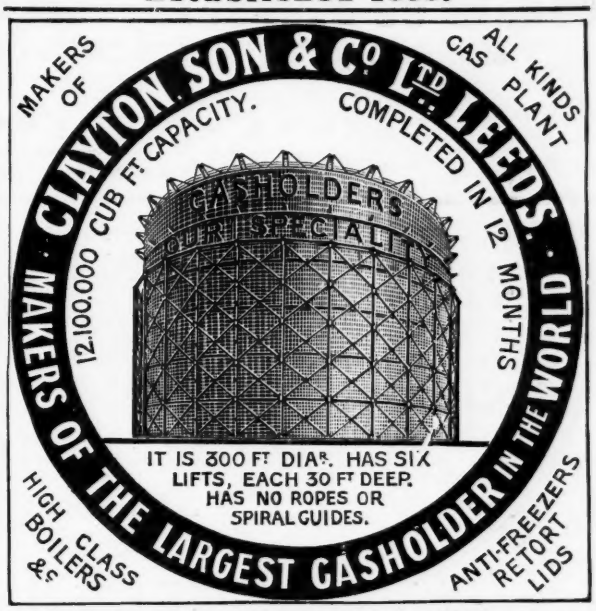
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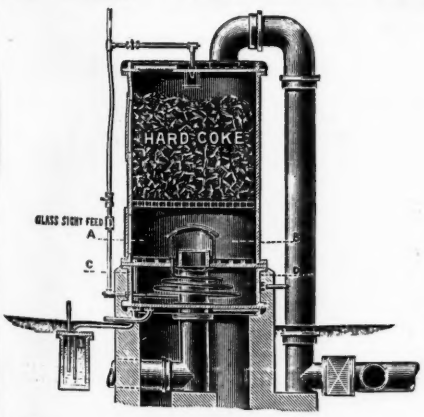

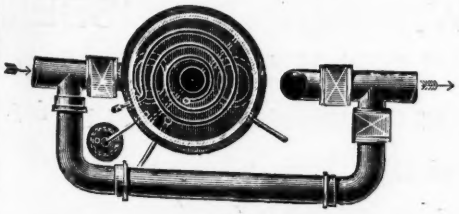

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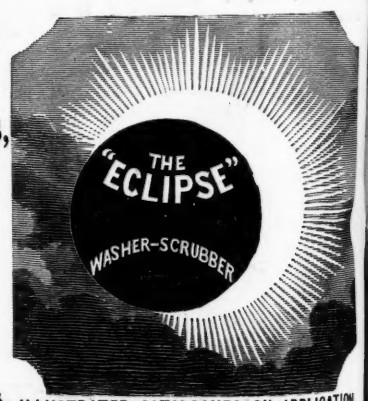

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